PROVIDENCE HARBOR

An Agenda for Action

A Report to the HARBOR ESTUARY AND LAND PLANNING Advisory Committee

Prepared for the Coastal Resources
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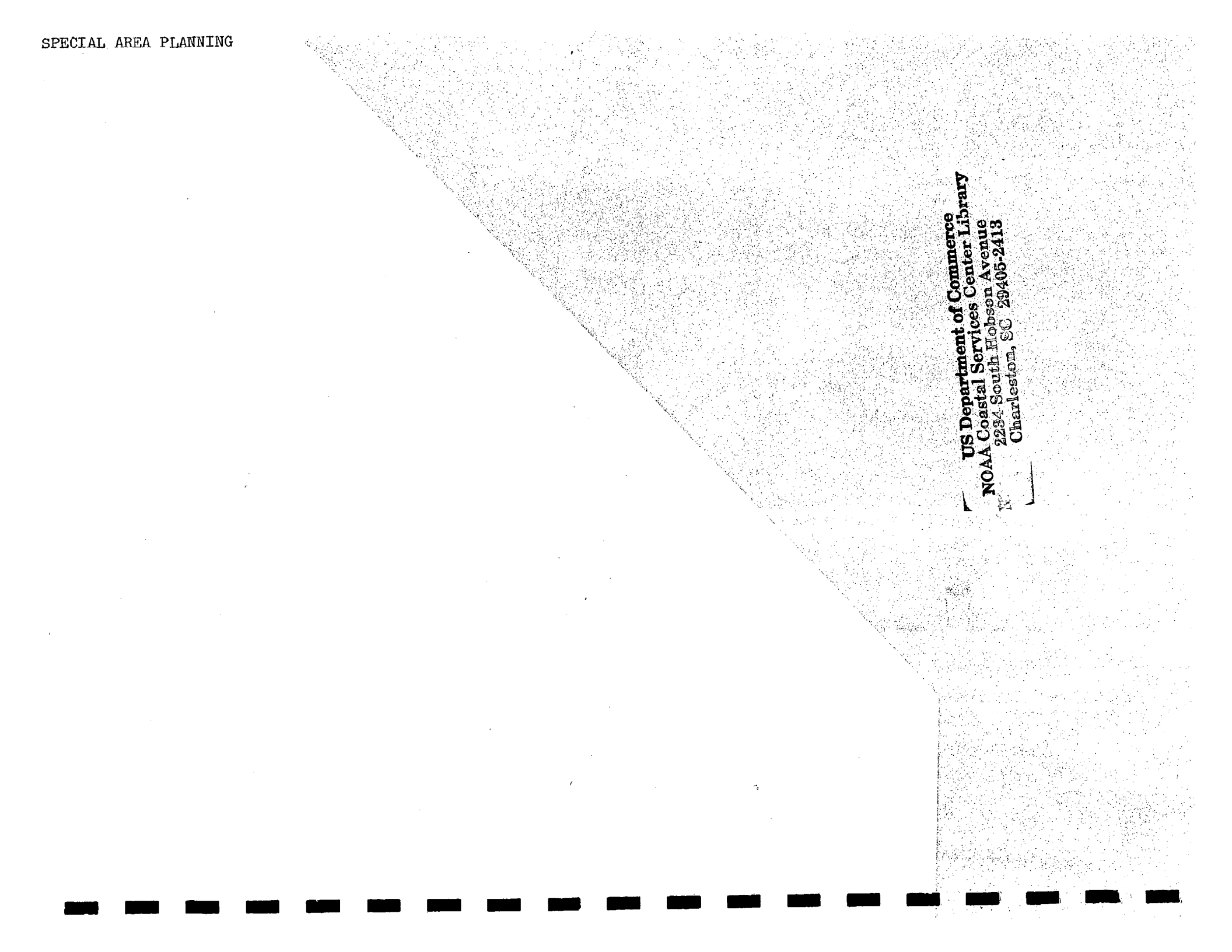
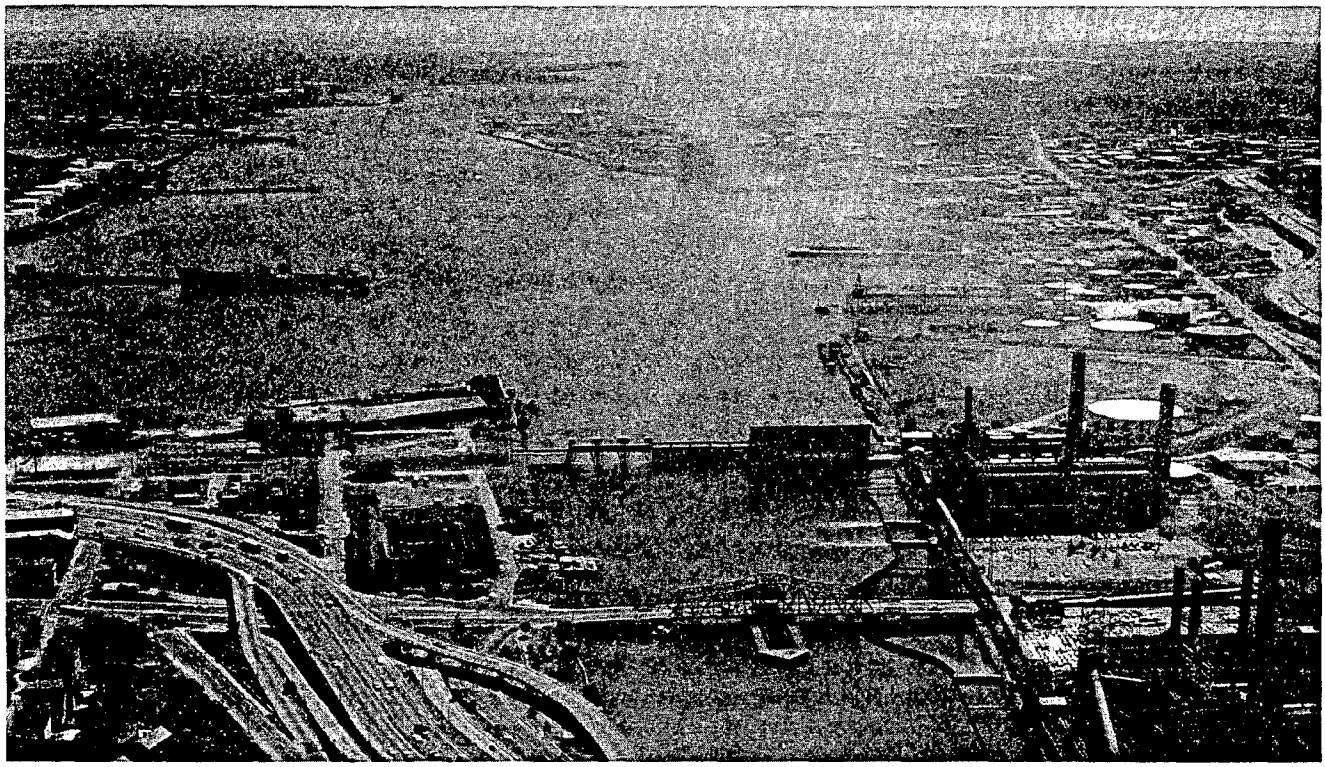
stal Resources Center·URI·1982



CRMC

RHODE ISLAND COASTAL RESOURCES MANAGEMENT COUNCIL

BRIEFING.32



A Special Area Plan For Providence Harbor?

Rhode Island's commercial waterfronts continue to make an important contribution to the state's economy. However, as economic conditions change, facilities become obsolete, begin to deteriorate, and are no longer easily re-used. When this deterioration occurs on a large scale, as it has along the Providence Harbor shoreline during the past forty years, the situation demands public attention and concern.

The Coastal Resources Management Council recognizes the need for a concerted effort to foster water front revitalization, and believes that it can play an important role as a catalyst in this process.

A Special Area Plan for Providence Harbor could stimulate and guide the redevelopment of the old waterfront (northward from Sabin Point and Pawtuxet Neck in the Providence River, to the head of the Seekonk River in Pawtucket). A draft plan for consideration by the Council is currently being prepared by the Coastal Resources Center of the University of Rhode Island. Several other groups are already trying to achieve Harbor improvements. These efforts must be recognized, encouraged and supported by a basic commitment to the future of urban waterfront goals through coordinated public agency programs, private investments and broad-based public support. To this end, the CRMC is proposing four goals for Providence Harbor:

- *balanced and compatible improvements in shoreline use*
- *improved water quality*
- *increased recreational opportunities and public access*
- *continued port industry development*

In the short term, the Council believes that progress can be made simultaneously toward each goal without significant conflicts. However, to avoid a collision among competing demands for waterfront land in the decades ahead, it is essential to plan now for the physical development of the Harbor, in a manner which carefully balances public and private uses and creates the best climate for the investments needed to meet each goal.

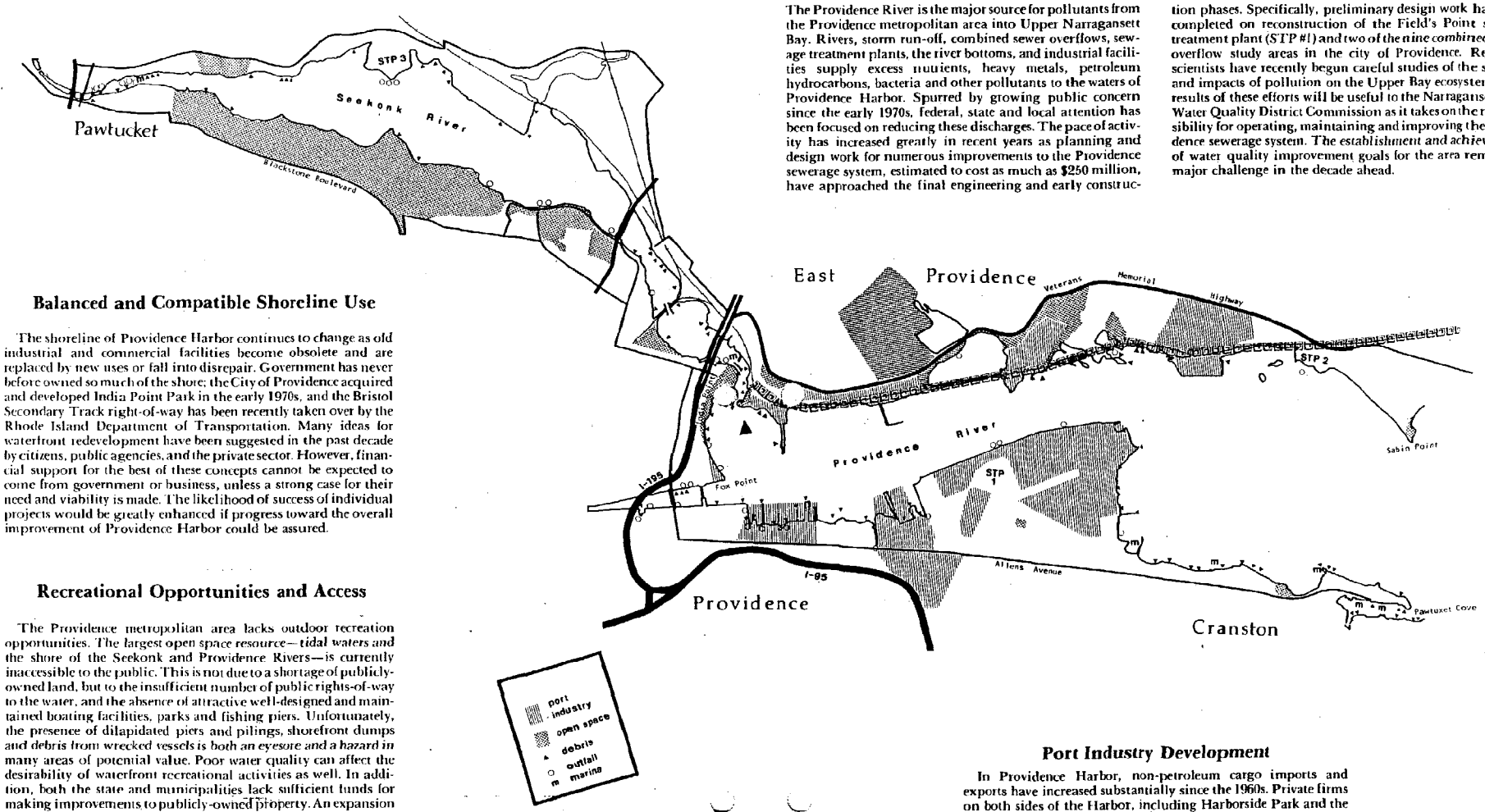
Continued on back page

Balanced and Compatible Shoreline Use

The shoreline of Providence Harbor continues to change as old industrial and commercial facilities become obsolete and are replaced by new uses or fall into disrepair. Government has never before owned so much of the shore; the City of Providence acquired and developed India Point Park in the early 1970s, and the Bristol Secondary Track right-of-way has been recently taken over by the Rhode Island Department of Transportation. Many ideas for waterfront redevelopment have been suggested in the past decade by citizens, public agencies, and the private sector. However, financial support for the best of these concepts cannot be expected to come from government or business, unless a strong case for their need and viability is made. The likelihood of success of individual projects would be greatly enhanced if progress toward the overall improvement of Providence Harbor could be assured.

Recreational Opportunities and Access

The Providence metropolitan area lacks outdoor recreation opportunities. The largest open space resource—*tidal waters and* the shore of the Seekonk and Providence Rivers—is currently inaccessible to the public. This is not due to a shortage of publicly-owned land, but to the insufficient number of public rights-of-way to the water, and the absence of attractive well-designed and maintained boating facilities, parks and fishing piers. Unfortunately, the presence of dilapidated piers and pilings, shorefront dumps and debris from wrecked vessels is *both an eyesore and a hazard in* many areas of potential value. Poor water quality can affect the desirability of waterfront recreational activities as well. In addition, both the state and municipalities lack sufficient funds for making improvements to publicly-owned property. An expansion of commercial recreation opportunities, such as marinas and restaurants, is limited in part by the present dim prospects for harbor redevelopment.



Improved Water Quality

The Providence River is the major source for pollutants from the Providence metropolitan area into Upper Narragansett Bay. Rivers, storm run-off, combined sewer overflows, sewage treatment plants, the river bottoms, and industrial facilities supply excess nutrients, heavy metals, petroleum hydrocarbons, bacteria and other pollutants to the waters of Providence Harbor. Spurred by growing public concern since the early 1970s, federal, state and local attention has been focused on reducing these discharges. The pace of activity has increased greatly in recent years as planning and design work for numerous improvements to the Providence sewerage system, estimated to cost as much as $250 million, have approached the final engineering and early construction phases. Specifically, preliminary design work has been completed on reconstruction of the Field's Point sewage treatment plant (*STP #1*) and *two of the nine combined sewer* overflow study areas in the city of Providence. Research scientists have recently begun careful studies of the sources and impacts of pollution on the Upper Bay ecosystem. The results of these efforts will be useful to the Narragansett Bay Water Quality District Commission as it takes on the responsibility for operating, maintaining and improving the Providence sewerage system. *The establishment and achievement* of water quality improvement goals for the area remains a major challenge in the decade ahead.

Port Industry Development

In Providence Harbor, non-petroleum cargo imports and exports have increased substantially since the 1960s. Private firms on both sides of the Harbor, including Harborside Park and the Providence and Worcester Railroad marine terminal, continue to

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Continued from p. 3

invest in port facilites and seek to increase the volume and varieties of cargoes handled. A key to the future growth of many of the firms involved in the port industry is the success of the Municipal Wharf, owned and operated by the City of Providence. Since 1963, $13.6 million in capital expenditures financed by municipal general obligation bonds has been spent to improve ship berths and build a new terminal building, and offices. However, numerous problems remain, including finding a site and method for the disposal of dredged materials, the acquisition of cranes for unloading containerized cargoes, the completion of berth improvements and the demolition of an old terminal building. Port revenues and net income have fluctuated greatly since 1978, while expenses continue to rise. The organizational structure and authorities of the Municipal Wharf have been virtually unchanged since the 1920s. A long-term port planning initiative is needed, which would increase the competitiveness and economic input of port operations, including consideration of improving marketing management, capital improvement programming and the supporting network of rail and highway service to both sides of the river.

Continued from p. 1

Conclusion

In keeping with its legislative mandate to plan for the future of Rhode Island's coastal areas, these four topics (p. 1) are presently the focus of a Special Area Plan.

As the problems become more clearly defined through the ongoing efforts of Coastal Resources Center, the Council will be exploring goals for the area with existing agencies and interested groups.

BRIEFING is published by the Rhode Island Coastal Resources Management Council which was created in 1971 by the General Assembly to maintain and regulate Rhode Island's coastal resources. The Council is mandated by law to protect and preserve the state's shoreline and coastal waters and publishes this newsletter to keep Rhode Islanders informed of its management program.

The CRMC maintains a Speakers' Bureau that is available upon request to groups and organizations. A slide show is also available. Requests for speakers should be addressed to Speakers' Bureau, Coastal Resources Management Council, 60 Davis Street, Providence, R.I. 02908.

Gayle Wood, Editor

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BRIEFING 32

Coastal Resources
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REPORT OF THE WORKING GROUPS OF THE HARBOR ESTUARY AND LAND PLANNING (HELP) ADVISORY COMMITTEE TO THE COASTAL RESOURCES MANAGEMENT COUNCIL

A Report of the Harbor Estuary and Land Planning Advisory Committee

to the

Coastal Resources Management Council

April 1982

Prepared by the Coastal Resources Center
Graduate School of Oceanography
University of Rhode Island
Narragansett, RI

Donald Robadue, Jr., Project Coordinator

The preparation of this report was financed in part by a grant from the National Oceanic and Atmospheric Administration under the provisions of the Coastal Zone Management Act of 1972 (Public Law 92-583).

REPORT OF THE WORKING GROUPS OF
THE HARBOR ESTUARY AND LAND PLANNING (HELP) ADVISORY COMMITTEE
TO THE COASTAL RESOURCES MANAGEMENT COUNCIL
April 28, 1982

THE HELP COMMITTEE CHARGE

The Harbor Estuary and Land Planning (HELP) Advisory Committee was established in January 1982 to assist the Urban Waterfronts Subcommittee of the Coastal Resources Management Council (CRMC) in its effort to develop a Special Area Management Plan for Providence Harbor. The purpose of this proposed plan is twofold. First, the CRMC seeks to foster a concerted effort for waterfront revitalization. Secondly, the CRMC desires to assure a careful balance of public and private uses in the area in order to achieve the goals of increased recreational opportunities, port development, compatible shoreline uses and improved water quality.

The first assignment for the HELP Committee was to consider three major harbor problems: port development, debris removal and shoreline redevelopment. Working groups were formed to examine options for solving each problem. The groups considered both near term actions which could be taken by the CRMC and other agencies as well as long term goals and policies for inclusion in the Special Area Management Plan.

SUMMARY OF RECOMMENDATIONS

The Port Industry

Maritime commerce is the dominant use of the Providence River portion of Providence Harbor. The port industry in the Harbor continues to experience several difficulties as it searches

for an identity as one of many small East Coast ports engaged in coastal and international trade. Sixty percent of port industry employment is involved in handling non-petroleum cargo, which comprises only 18 percent of Harbor traffic. Much of this non-petroleum cargo is shipped or received at the Municipal Wharf operated by the City of Providence. For many years, public officials and port industry members have proposed that the Municipal Wharf be provided decision-making independence and adequate financial resources in order to be more competitive. The Port Industry Working Group examined the problems facing the industry and considered options for introducing an effective management structure into the Harbor.

Two questions must be addressed by any proposal for institutional change: who will become responsible, and what will their role be? Four options were considered by the Working Group as potential locations for authority and responsibility:

1. City of Providence Port Department (slated to be created in 1983 in the Home Rule Charter)
2. Rhode Island Port Authority (RIPA)
3. Independent state organization
4. Independent organization of municipalities

The favored option was the addition of Providence Harbor as one of the projects of the Rhode Island Port Authority, accompanied by an expansion of the mandate of the Department of Economic Development and broader representation on RIPA by Harbor communities. The Rhode Island Port Authority, in its enabling legislation, was

given the responsibility to: "foster and improve the handling of waterborne commerce from and to any port of this state and other states and foreign countries." (GLRI 42-64-2(g)) RIPA was provided with a broad range of powers to carry out its mission and has several years of experience in managing projects. It appears to be in the best position to take up responsibilities in Providence Harbor.

The other options were found to have drawbacks which would impede the success of a new management program. The City Port Department, when established, will be an important step forward in the consolidation of port functions. Many of the problems which the industry faces could be addressed to some extent by a Port Department with adequate financial resources. However, the Department will have to compete directly with other City agencies for funds and will be subject to the same decision-making procedure which has been the source of decades old concern. In addition, the perspective of a Port Department will be dominated by the Municipal Wharf, leaving the establishment of a Harbor wide management approach waiting to be accomplished.

An independent state authority would be desired if RIPA cannot be encouraged to increase its involvement in Providence Harbor. However, it would be required to duplicate many of RIPA's powers in order to be effective. It would not have direct access to existing economic development tools and resources and would lack a Bay-wide facility development perspective.

If no state initiative was forthcoming, the municipalities around the Harbor could establish their own organization or authority. In addition to duplicating RIPA powers, which may not be possible in any case, the cities do not have access to sufficient financial resources or expertise and may find it difficult to act with the broader Harbor and Bay-wide perspective which is clearly needed.

Five levels of port management were considered by the Working Group:

1. Trade association/advisory committee
2. Targeted grants-in-aid
3. Grants-in-aid plus Narragansett Bay port study
4. Limited facility management arrangements
5. Full Harbor facility management

The favored level of involvement for the Rhode Island Port Authority was level 4, limited facility management, in which RIPA would not only hold meetings, conduct studies and supply grants but would establish arrangements to operate some or all of the berths at the Municipal Wharf. This would assure that management or marketing recommendations were implemented and would place the burden of financing facility improvements on the State, while providing the City of Providence with annual payments sufficient to offset the cost of previous improvements to the wharf.

Levels of involvement 1 through 3 can be viewed as a logical progression of steps which RIPA could take as it pursues the goal of limited facility management, should that prove to be necessary. It would be easy to implement Level 1, while new appropriations from the General Assembly would be required to

undertake a program of grants-in-aid or a major port marketing and management study.

Once a final HELP Advisory Committee recommendation is developed, the next step will be to arrange meetings with a broader group of individuals concerned with the port industry, including the Governor's Office, state agencies, members of RIPA, the municipalities, the General Assembly and port businesses. The analysis and proposals developed by the HELP Committee will provide a solid framework for serious discussion of a state port policy which sets a clear course of action for improving Harbor management.

Debris Removal

Approximately 27,000 cubic yards of debris clutter the shoreline of Upper Narragansett Bay. Half of this total is owned by 33 firms,individuals or public agencies in Providence Harbor.in the form of abandoned and deteriorating wharves, piers and docks. It would cost more than $2 million to remove these structures.according to the U.S. Army Corps of Engineers. A plan for debris removal proposed by the Corps of Engineers in 1978 called for a cost sharing project in which communities would pay three fourths of an estimated $4.8million comprehensive clean-up.(1981 dollars.)

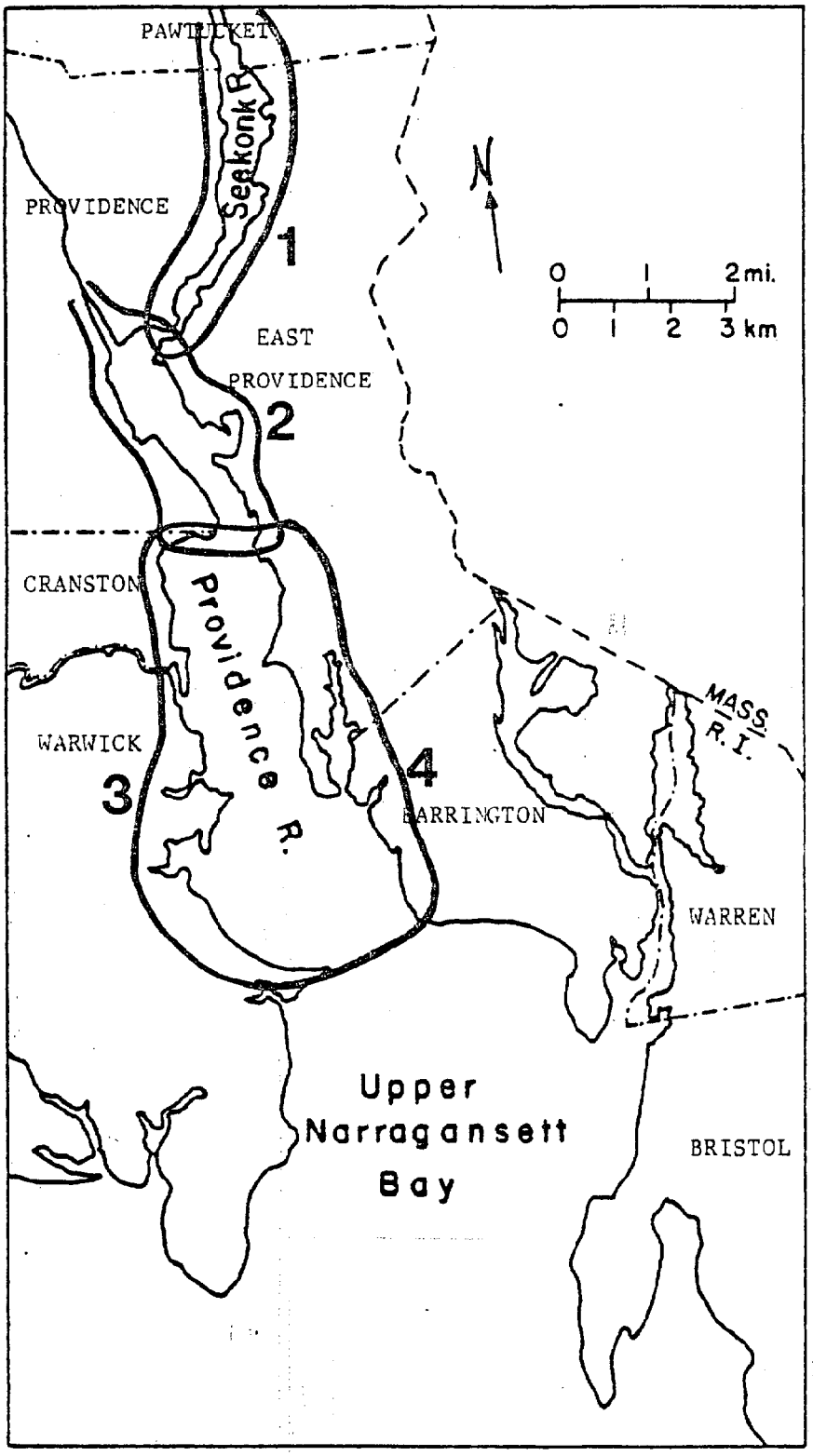
The Coastal Resources Management Council and the Department of Environmental Management have the responsibility and authority to seek the removal of shoreline debris caused by abandoned structures and vessels. The Debris Removal Working Group considered options for proceeding with the implementation of this

state policy which would have the greatest chance of success.

The Working Group concluded that the State should support the Corps of Engineers project which is still in preparation but work separately to reduce the inventory of debris sources through its own program of incentives to debris owners. In this way, the future State and local share of the federal project, should it ever be funded, would be reduced. In the meantime, a substantial clean-up of the shore would have taken place. Some of the incentives to be provided to debris owners include:

* a reduced rate for disposal at the sanitary landfill operated by the Solid Waste Management Corporation
* onsite inspections and certification by DEM
* coordinated clean up plans in subareas of the Harbor to acheive economies of scale in equipment mobilization and transportation
* area committees to encourage participation and identify economical removal practices

The Debris Removal Working Group recommended that the debris removal project, which encompasses the full length of the Seekonk and Providence Rivers be divided into subareas, shown in Figure 1. The Seekonk River was recommended as the first subarea for which a Debris Removal Task Force should be created. It would be composed of debris owners, citizens, public officials and contractors. The Task Force would supervise the preparation of a detailed plan for the clean up of the River, provide encouragement to debris owners for participation in the state program,organize volunteer clean up of loose onshore debris and



Upper Narragansett Bay and Tidal Tributaries

Figure 1 Debris removal project areas.

serve as a model for future efforts in other subareas.

A letter and questionnaire informing the 33 major owners about the state debris removal program, and requesting verification of the data gathered by the U.S. Army Corps of Engineers as updated by the Coastal Resources Center was mailed on April 23, 1982. The next step will be to implement the Debris Removal Working Group recommendations by convening the Seekonk River Task Force and developing a detailed removal plan for that area.

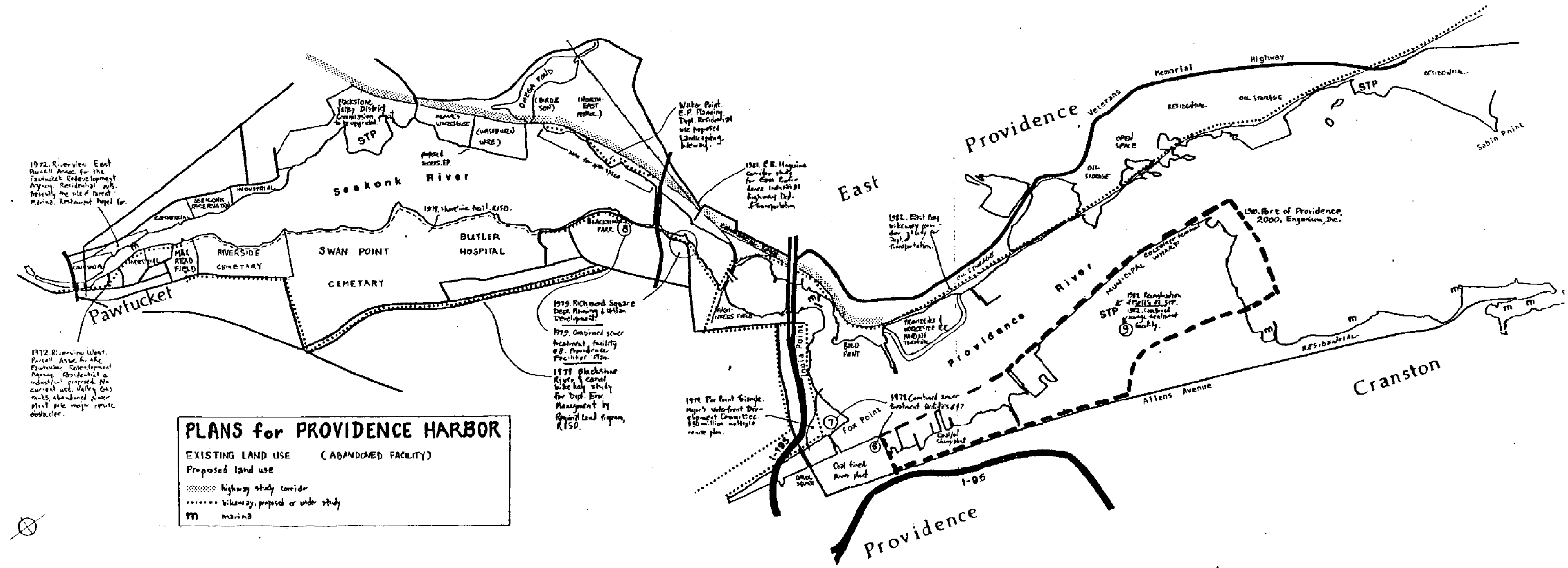
Shoreline Use

The assignment of the Shoreline Use Working Group was the broadest in scope. Discussion began with an assessment of the potential of increasing the commercial, recreational and residential value of Providence Harbor to the metropolitan area. Concensus was easily reached on the point that the region is indeed suitable for much more of those uses, and that the positive attributes of the Harbor are not generally recognized by the public. There was also agreement that the Harbor is plagued by a number of problems, including the visual impact of debris and polluted water, flood hazards and construction problems, the lack of a mechanism for overcoming obstacles to redevelopment, and the absence of a linkage among the various site development and access plans which have been proposed in recent years.

The Working Group then set out to define the appropriate role of the coastal resources management program in fostering

the improved utilization of waterfront land, given the fact that municipal governments have the primary responsibility for guiding the physical development of their communities. The answer to this question will determine the shape of the special area plan. It was observed that there has been no shortage of ideas and plans for various stretches of the Harbor shore, as Figure 2 illustrates. Many areas have been the subject of planning studies by state or municipal agencies, as well as the private sectore. Unfortunately, few of these ideas have reached the public eye, much less the stage of implementation. Until now, there has been no opportunity to examine the effect of these proposals on the overall development of the Harbor, or discuss ways in which a plan to redevelop Providence Harbor as a whole could assist the best ideas to obtain the public and private support they need.

The approach recommended to the Coastal Resources Management Council by the Working Group emphasizes the need for increasing public awareness of the need for a Harbor redevelopment effort, and the need as well for a continuing mechanism through which ideas and proposals can be spotlighted to provide recognition and coordinated to insure compatibility. This task is seen as one of the major continuing activities of a permanent Harbor Estuary and Land Planning Advisory Committee to CRMC which could then lead to a meaningful special area plan. The possible futures for Providence Harbor must be explored directly with the municipalities of Pawtucket, Providence, East Providence,


PLANS for PROVIDENCE HARBOR
EXISTING LAND USE
(ABANDONED FACILITY)
Proposed land use
highway study corridor
bikeway, proposed or under study
m marina
Pawtucket
Seekonk River
SWAN POINT
CEMETARY
BUTLER
HOSPITAL
RIVERSIDE
CEMETARY
East
Providence
Veterans
Memorial
Highway
Providence River
Fox Point
India Point
Allens Avenue
Cranston
Providence
I-95
I-195
STP
Sabin Point
1990. Port of Providence, 2000, Engenium, Inc.

Cranston and Warwick in a format which expands the scope and participation in the discussions. The first step in this effort will be to invite each of the municipalities to present their program for waterfront redevelopment to the HELP Advisory Committee and the CRMC as a means of demonstrating to each community the statewide interest in their problems and plans, as well as learning first hand the intentions and aspirations of each city for its waterfront.

Harbor & Bay

June 1982 Number 1

A NEWSLETTER ABOUT RHODE ISLAND'S LARGEST URBAN WATERFRONT

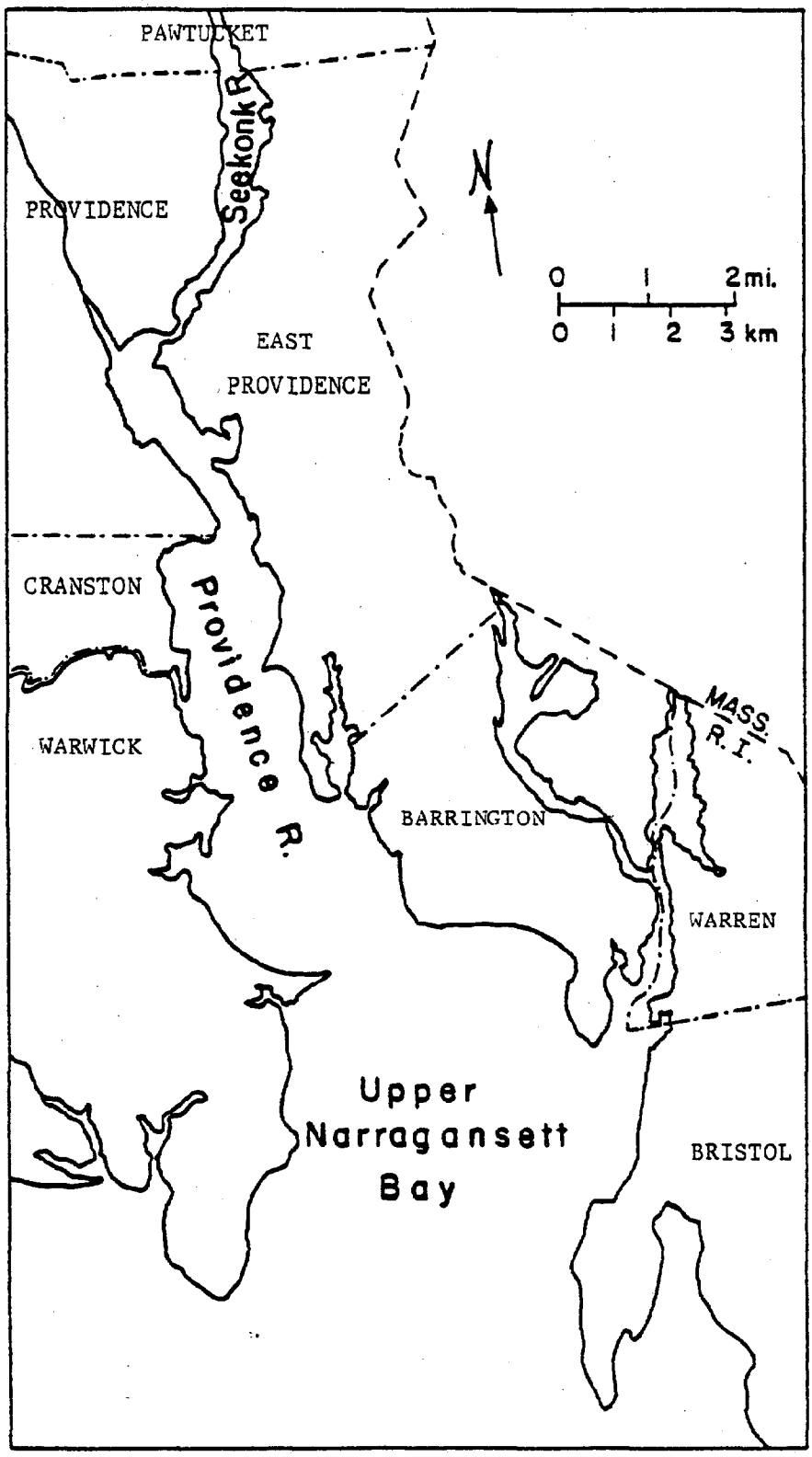
The objective of this newsletter is to provide a forum for the exchange of information, ideas and concerns relating to the problems which exist along the coast and waters of Providence Harbor and Upper Narragansett Bay.

The Seekonk and Providence Rivers (Providence Harbor) and the Upper Narragansett Bay are a complex and heavily utilized portion of the Narragansett Bay estuary. The region is surrounded by the Providence metropolitan area, and nearly one million people inhabit its 2160 km^2 watershed. The shore and waters of this urbanized estuary are afflicted by many of the ills of urban waterfronts elsewhere in the nation: pollution, deteriorated buildings and port facilities, underutilized industrial sites, lack of access to the water, and shoreline debris. The public response to these problems has been hampered by a general lack of understanding of opportunities and potential for revitalization.

Important activities are now taking place to overcome decades of neglect and disinterest in the waterfront. New port operations have been initiated and new facilities are being built. The Narragansett Bay Commission has taken over operation of the Providence sewage system and plans both operational and facility improvements. Several scientific studies promise to improve our understanding of water pollution problems. A cooperative debris removal program has been organized by the Department of Environmental Management and the Coastal Resources Management Council. The Harbor Estuary and Land Planning (HELP) Advisory Committee to the CRMC has completed its first report as part of the Coastal Program's effort to develop a Special Area Management Plan for Providence Harbor.

In this and subsequent issues of the HARBOR & BAY newsletter, we will focus on these and other efforts to solve the problems of Providence Harbor and Upper Narragansett Bay, and tap its potential as a valuable coastal resource.

A Newsletter of Providence Harbor and the Upper Narragansett Bay



Upper Narragansett Bay and Tidal Tributaries

We hope that all of those who are interested in solving urban waterfront problems will utilize this newsletter to keep their colleagues up to date by submitting to us reports on their activities, ideas and insights.

HARBOR ESTUARY AND LAND PLANNING (HELP) ADVISORY COMMITTEE ISSUES FIRST RECOMMENDATIONS TO COASTAL RESOURCES MANAGEMENT COUNCIL

The HELP Committee, composed of 22 members representing a wide range of individuals concerned with the metropolitan area's urban waterfront, have met frequently since January 1982 to provide the Coastal Resources Management Council (CRMC) Subcommittee on Urban Waterfronts and Dredging with advice on three critical Providence Harbor issues. Working groups on the port industry, debris removal, and shoreline use met monthly to consider near-term actions and long-range goals and policies for inclusion in the Special Area Management Plan for Providence Harbor currently being prepared by CRMC. At its April 28, 1982 meeting, the newly established Harbor Estuary and Land Planning Advisory Committee submitted its initial recommendations on actions needed to improve the prospects for revitalizing the Providence Harbor waterfront. These findings are summarized below.

The Port Industry

Maritime commerce dominates the Providence River portion of Providence Harbor. The industry in the harbor continues to experience as it searches for an identity as one of many small East Coast ports engaged in coastal and international trade. Sixty (60) percent of all port industry employment in the Harbor is involved in handling non-petroleum cargo, which comprises only 18 percent of Harbor traffic. Most of this cargo is shipped or received at the Municipal Wharf operated by the city of Providence. Projections by the Coastal Resources Center at the University of Rhode Island indicate that in fiscal year 1982, total expenses including repayment of bonds and notes for recent port improvements will be $2.2 million, while port revenues are expected to be about $700,000. Unless port revenues increase dramatically in the next five years, this imbalance is expected to continue.

For many years, public officials and port industry members have proposed that the Municipal Wharf be provided decision-making independence and adequate financial resources in order to be more competitive, increase cargo flows and be self supporting. The Port Industry Working Group of the HELP Committee considered four options for the locations of authority and responsibility:

1. City of Providence Port Department (to be created in 1983 when a home rule charter is implemented)
2. Rhode Island Port Authority
3. Independent state organization
4. Independent organization of municipalities

In addition, the Working Group examined five levels of involvement by a new management agency in Providence Harbor:

a. Trade association/advisory committee
b. Targeted grants-in-aid to solve specific problems
c. Grants-in-aid plus a Narragansett Bay port study
d. Limited facility management arrangements
e. Full harbor facility management by central agency

The Working Group favored the involvement of the Rhode Island Port Authority, whose present legislative mandate includes the responsibility to "foster and improve the handling of waterborne commerce from and to any port of this state and other states and foreign countries". The Working Group felt that limited facility management by an independent agency would be required to implement improvement management and marketing efforts.

It urged that efforts begin at once to initiate serious discussion of improving port management in Providence Harbor.

Debris Removal

About 27,000 cubic yards of shoreline debris litter the shoreline of Providence Harbor and Upper Narragansett Bay. Half of this total in the form of abandoned and deteriorating wharves, piers and docks is owned by 33 firms, individuals or public agencies. Shoreline debris poses a constant hazard to navigation, detracts from the visual quality of the shore and water, and restricts commercial and recreational use of the waterfront.

The Coastal Resources Management Council and the Department of Environmental Management have the responsibility and authority to seek the removal of shoreline debris caused by abandoned structures and vessels. The Debris Removal Working Group considered options for proceeding with the implementation of this authority. The Army Corps of Engineers has estimated that removal of shorefront structures alone would cost more than $2 million.

The Working Group concluded that the state should support an Army Corps of Engineers' project still underway which would enable a clean up of loose debris and wrecked vessels but also begin immediately to reduce the huge inventory of debris through its own program of incentives and enforcement of existing regulations. Incentives to be provided to debris owners include:

1. Reduced rate for disposal at the sanitary landfill operated by the Solid Waste Management Corporation

2. Onsite inspections and certification by DEM and CRMC

3. Coordinated clean-up plans in sub-areas of the harbor to achieve economies of scale in equipment mobilization and transportation

4. Area committees to encourage participation and identify economical removal practices

The Seekonk River was identified by the Working Group as a good candidate to establish the first Debris Removal Task Force.

Shoreline Use

Improving the quality of shoreline development in Providence Harbor, after many decades of deterioration and decline, is a major challenge which faces the communities surrounding the Seekonk and Providence Rivers and Upper Narrragansett Bay. Cities across the nation are rediscovering the untapped economic and public values which are hidden under obsolete shorefront facilities and unproductive waterfront property. The Shoreline Use Working Group quickly concluded that the Providence Harbor area is indeed suitable for a wide range of private and public uses than presently exist. There was also agreement that some areas are plagued by problems including the visual impact of debris polluted water and flood hazards. The lack of a mechanism for overcoming obstacles to redevelopment and the absence of a linkage among the various site development and access plans which have been proposed in recent years are major impediments to a

successful harbor wide redevelopment effort.

The Working Group noted that there have been numerous planning studies and waterfront proposals in recent years, but that few of these concepts ever reach the public's attention and there has been no opportunity to examine the effect of these proposals collectively on the harbor. No discussions have taken place regarding ways in which a plan to redevelop Providence Harbor as a whole could assist individual development proposals to obtain the public and private support they require.

The Working Group recommended that the HELP Advisory Committee begin the process of increasing public awareness for the need for a harbor redevelopment effort, and provide a continuing means through which ideas and proposals can be spotlighted, discussed and coordinated. It also recommended that each community around the harbor be asked to present its vision of waterfront development along its shore, since municipalities have the primary responsibility for controlling and stimulating land development.

CRMC Urban Waterfronts Subcommittee Response

The recommendations for near-term actions submitted by the HELP Advisory Committee are being implemented. A paper entitled "Organizational Remedies to Port Industry Problems in Providence Harbor" which summarizes the Port Industry Working Group recommendations has been distributed to key state and local public officials in preparation for a meeting on the subject of improved port planning and management in Providence Harbor.

The Department of Environmental Management and the Coastal Resources Management Council have mailed a questionnaire to the 33 major debris owners requesting verification of data on the condition of shorefront structures and informing them of the state program. More than half of the owners have already responded which will lead to site visits and determinations of clean-up needs.

Finally, a meeting has been held with planners from the municipalities surrounding the Providence Harbor and Upper Narragansett Bay to prepare for their forthcoming presentations of community waterfront goals and plans to the HELP Advisory Committee.

CORRESPONDENCE SOUGHT ON HARBOR AND BAY EVENTS AND INFORMATION

Contributions are being solicited from all readers on topics which involve the harbor and bay. Information is needed on the plans for and results of scientific, social and economic research. Descriptions of decisions, actions and issues in Harbor and Bay communities which pertain to the shoreline and water are also sought. Although the editorial emphasis will be placed upon the factual presentations of infomation, brief signed statements of opinion on relevant topics will also be printed with an opportunity provided for the expression of contrasting viewpoints.

Send all correspondence to:

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Coastal Resources Center
Graduate School of Oceanography
Narragansett RI 02882

or call: (401) 792-6224.

TO RECEIVE THE HARBOR & BAY NEWSLETTER, SIMPLY CALL OR WRITE TO THE COASTAL RESOURCES CENTER

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Editor: Donald Robadue, Jr.

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COASTAL RESOURCES CENTER
University of Rhode Island
Narragansett Bay Campus
Narragansett RI 02882

Harbor & Bay

July 1982 Number 2

FIELD SAMPLING AND SCIENTIFIC STUDIES PLANNED FOR THE SUMMER OF 1982 IN THE HARBOR AND BAY

This summer, Upper Narragansett Bay and the Providence River will be the focus of several new and ongoing research efforts to define the sources of pollution problems and investigate the implications for the health of the estuary. Many of these studies will have applications in urbanized and polluted estuaries nationwide.

Oxygen

Dr. Scott Nixon of URI's Graduate School of Oceanography is embarking on a two-year study of the low oxygen conditions in the Seekonk and Providence Rivers. During the first year, the Sea Grant-sponsored project will examine the relative importance of sources of biological oxygen demand (BOD). Oxygen, BOD loadings, ammonia and nitrate will be measured biweekly in each of the three major rivers: Blackstone, Woonsquatucket/Moshassuck, and Pawtuxet and at the three major sewage treatment plants: Field's Point, Bucklin Point and East Providence. In addition the research team will sample a major combined sewer overflow (CSO) and estimate BOD loadings entering the Providence River from the Upper Bay. In the second year of the project they will examine the oxygen dynamics in the Providence River itself, including phytoplankton productivity, flux from the bottom and air-sea interchange.

Petroleum hydrocarbons

As part of a study of hydrocarbons and other pollutants in urban runoff and CSOs with funding from NOAA's Office of Marine Pollution Assessment, Dr. Eva Hoffman, a chemist at the University of Rhode Island, will be out sampling the Providence River before, during and after rainstorms this summer. She is hoping to determine in better detail the effect of storms on water quality. In addition to measuring hydrocarbons, her team from the Graduate School of Oceanography will analyze for lead and copper. Since lead results primarily from runoff and the major source of copper is the Field's Point Plant, ratios of the metals will help determine the source of the hydrocarbons. Sampling the Field's Point Plant will continue in order to

A Newsletter of Providence Harbor and the Upper Narragansett Bay

complete her series comparing the effectiveness of hydrocarbon removal during wet and dry conditions, summer and winter.

Mussels

Cages of mussels will be placed in the upper and lower Bay next month by divers from the Environmental Protection Agency's Marine Research Laboratory in Narragansett under the direction of Dr. Donald Phelps. They will be retrieving some of the mussels each month and analyzing for levels of heavy metals and some organic chemicals in the tissue. They will also be sampling natural mussel populations from Ohio Ledge (off the north end of Prudence Island) and Beavertail (Jamestown) and determining a growth index called "Scope for Growth." This index reflects the growth potential of the mussels. Previous work has indicated when mussels were transplanted from the lower Bay to Conimicut Point their scope for growth decreased by 75 percent. Petroleum hydrocarbons in mussels increase 10 x from the EPA laboratory to Sabin Point. Heavy metals increase 3-5 x and PCBs 4 x.

Combined Sewer Overflows

E.C. Jordan of Portland, Maine has been hired by EPA to conduct a nationwide CSO sampling study. In addition to Providence, overflows will be studied in St. Louis, St. Paul and Seattle. The purpose of the study is to determine the concentration of 129 "Priority Pollutants." Samples will be taken at Ernest and Allen Streets and Dexter and Huntington in CSO area #002. The company has already completed a 24-hour background study during dry weather and they plan to measure three storms at each sampling site.

pH

URI's Marine Ecosystem Research Laboratory (MERL) has developed predictions from experiments in large tanks which they plan to test in the Providence River this summer. PH (the degree of acidity or alkalinity) has fluctuated more in tanks with high levels of nutrient addition than in those with lower nutrients. MERL will sample pH at dawn and dusk.

Bacteriological Analyses

The Rhode Island Department of Environmental Management's Division of Water Resources will be continuing its once weekly monitoring of bacterial levels in the Upper Bay. Water samples are analyzed for coliform bacteria which are used as an indicator for the presence of pathogens. Each week the Upper Bay and another selected area, such as Greenwich Bay, the West Middle Bay, East Middle Bay or the Barrington River are surveyed. In addition, DEM conducts routine monitoring of bacterial levels at bathing beaches.

River Sampling

Water quality in the Ten Mile River and the Moshassuck River (two of the rivers which drain into the Upper Bay) will be surveyed this summer by the Division of Water Resources in DEM. Twenty-four hour monitoring will determine the diurnal variation in concentrations of nutrients, metals, oxygen and biological oxygen demand at several sampling stations along each river.

Narragansett Bay National Estuarine Sanctuary

The National Estuarine Sanctuary, part of the Bay Islands Park System, is managed by the Department of Environmental Management. As the Sanctuary enters its second year of operation, efforts are beginning to develop the research potential of the area. Divers will conduct a survey of the

marine habitat in the sanctuary, which extends to the 18 foot depth north of Prudence, Patience and Hope Islands and an informational booklet describing research opportunities in the area will be prepared.

Water quality testing for coliform concentrations will be conducted every weekend in Potter Cove. A comparison with DEM's mid-week sampling will be used to assess the effects of weekend boating on coliform levels. Samples will also be taken immediately to the south of the conditional shellfish area for comparison with bacterial levels within the conditional area.

FOR MORE INFORMATION ON PROVIDENCE HARBOR AND UPPER NARRAGANSETT BAY

Several reports have been prepared for the Coastal Resources Management Council and its Harbor Estuary and Land Planning Advisory Committee by the Coastal Resources Center at the University of Rhode Island. Copies of these reports are supplied at no charge.

Send requests to: Coastal Resources Center
Graduate School of Oceanography
Narragansett RI 02882

UPPER NARRAGANSETT BAY: AN URBAN ESTUARY IN TRANSITION. 1980. D. Robadue and V. Lee. Coastal Resources Center. 137 pp. Introduces the problems of the Providence metropolitan area's waterfront.

RHODE ISLAND DREDGING NEEDS SURVEY, 1980-1985. 1981. Coastal Resources Center. 40 pp. Identifies the need for maintenance and development dredging at 200 marine facilities in Rhode Island.

THE PORT INDUSTRY IN PROVIDENCE HARBOR. 1982. D. Robadue, R. McKillop, D. Molzan. Coastal Resources Center. 60 pp. Survey of the port industry, including economic impact, cargo trends, and financial condition of the Municipal Wharf.

A SPECIAL AREA PLAN FOR PROVIDENCE HARBOR. Briefing...32. 1982. Rhode Island Coastal Resources Management Council. 4 pp. An introduction to the special Providence Harbor planning project.

REPORT OF THE WORKING GROUPS OF THE HARBOR ESTUARY AND LAND PLANNING ADVISORY COMMITTEE TO THE COASTAL RESOURCES MANAGEMENT COUNCIL. April 28, 1982. 11 pp. Summary of recommendations of the HELP Advisory Committee.

ORGANIZATIONAL REMEDIES TO PORT INDUSTRY PROBLEMS IN PROVIDENCE HARBOR. April, 1982. 10 pp. The Port Industry Working Group paper on options for improving port planning and management.

REVIEW OF THE CITY OF PROVIDENCE INDUSTRIAL WASTEWATER PRETREATMENT PROGRAM PRETREATMENT LIMITATIONS STUDY. Prepared by Charles Krasnoff Associates. March, 1982. E. Deason, D. Robadue, Coastal Resources Center. 16 pp. Summarizes and critiques the proposed industrial pretreatment effluent guidelines for the state's largest sewage system.

PLANNING FOR WATER QUALITY IMPROVEMENTS IN UPPER NARRAGANSETT BAY AND ITS TRIBUTARIES: SHELLFISHING. May 1982. E. Deason. Draft Report. Coastal Resources Center. 27 pp. Discusses the effects of pollution on the Upper Bay quahog resource, including both limitations on harvesting and quality of habitat, and explores the implications for pollution abatement strategies.

HARBOR & BAY is a publication of the Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island, Narragansett RI 02882.

Written by: Ellen Deason
Editor: Donald Robadue, Jr.

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Organizational Remedies for Port Industry Problems in Providence Harbor

A Report of the HARBOR ESTUARY AND LAND PLANNING Advisory Committee to the Coastal Resources Management Council

MAY 1982

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Donald Robadue, Jr., Project Coordinator

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ORGANIZATIONAL REMEDIES FOR PORT INDUSTRY PROBLEMS IN PROVIDENCE HARBOR

SUMMARY

The HELP Committee Charge

The Harbor Estuary and Land Planning (HELP) Advisory Committee was established in January 1982 to assist the Urban Waterfronts Subcommittee of the Coastal Resources Management Council (CRMC) in its effort to develop a Special Area Management Plan for Providence Harbor. The purpose of this proposed plan is twofold. First, the CRMC seeks to foster a concerted effort for waterfront revitalization. Secondly, the CRMC desires to assure a careful balance of public and private uses in the area in order to achieve the goals of increased recreational opportunities, port development, compatible shoreline uses and improved water quality. The first assignment for the HELP Committee was to consider three major harbor problems: port development, debris removal and shoreline redevelopment. Working groups were formed to examine options for solving each problem. The groups considered both near term actions which could be taken by the CRMC and other agencies as well as long term goals and policies for inclusion in the Special Area Management Plan.

The Port Industry Working Group

Maritime commerce is the dominant use of the Providence River portion of Providence Harbor. The port industry in the Harbor continues to experience several difficulties as it searches for an identity as one of many small East Coast ports engaged in coastal and international trade. Sixty percent of port industry employment is involved in handling non-petroleum cargo, which comprises only 18 percent of Harbor traffic. Much of this non-petroleum cargo is shipped or received at the Municipal Wharf, operated by the City of Providence, hence public action or inaction will play a critical role in determining the industry's future.

For many years, public officials and port industry members have proposed that the Municipal Wharf be provided decision-making independence and adequate financial resources in order to be more competitive. The Port Industry Working Group, composed of industry representatives and public officials, examined the problems facing the industry and considered options for introducing an effective management structure into the Harbor.

Recommendations

Two questions must be addressed by any proposal for institutional change: who will become responsible, and what will their role be? Four options were considered by the Working Group as potential locations for authority and responsibility:

A. City of Providence Port Department (slated to be created in 1983 in the Home Rule Charter)
B. Rhode Island Port Authority (RIPA)
C. Independent state organization
D. Independent organization of municipalities

Five levels of port management were also considered by the Working Group:

1. Trade association/advisory committee
2. Targeted grants-in-aid
3. Grants-in-aid plus Narragansett Bay port study
4. Limited facility management arrangements
5. Full Harbor facility management

The favored locus of responsibility for harbor management was the addition of Providence Harbor as one of the projects of the Rhode Island Port Authority, accompanied by an expansion of the mandate of the Department of Economic Development and broader representation of RIPA by Harbor communities (Option B). The Rhode Island Port Authority, in its enabling legislation, was given the responsibility to: "foster and improve the handling of waterborne commerce from and to any port of the state and other states and foreign countries." (GLRI 42-64-2(g)) RIPA was provided with a broad range of powers to carry out its mission and has several years of experience in managing projects. It appears to be in the best position to take up responsibilities in Providence Harbor.

The favored role for the Rhode Island Port Authority was level 4, limited facility management, in which RIPA would not only hold meetings, conduct studies and supply grants but would establish arrangements to operate some or all of the berths at the Municipal Wharf. This would assure that management or marketing recommendations were implemented and would place the burden of financing facility improvements on the State, while providing the City of Providence with annual payments sufficient to offset the cost of previous improvements to the wharf.

Levels of involvement 1 through 3 can be viewed as a logical progression of steps which RIPA could take as it pursues the goal of limited facility management. It would be easy to implement Level 1, while new appropriations from the General Assembly would be required to undertake a program of grants-in-aid or a major port marketing and management study.

INTRODUCTION

There are major problems facing the port industry in Providence Harbor which inhibit its ability to provide service to existing users of marine terminals, and make it inadequately prepared to take advantage of opportunities and cope with the uncertainties facing commercial shipping in the next two decades. About 60 percent of the 850 people directly employed in the industry depend on the 18 percent of existing harbor traffic which is non-petroleum cargo. The Municipal Wharf owned by the City of Providence is the principal facility which handles steel, lumber, automobiles, scrap metal, containers and other important non-petroleum commodities. Public control of this key facility has

been frequently cited as a primary reason for the inability of the industry to build proper facilities and capture new business. For many years, the port industry as well as some public officials have urged that a new organizational structure be introduced to Providence Harbor to provide better decision making, planning and management of commercial shipping facilities.

The purpose of this report is to identify the major problems affecting the port industry, define the basic reorganization options available to the state and city, and assess their advantages and disadvantages. The difficulty of implementing each option is also considered.

THE MAJOR PORT INDUSTRY PROBLEMS

Ten problems affect the ability of the port industry in Providence Harbor to successfully deal with the challenges of coastal and international shipping.

1. The role of the port industry in Providence Harbor must be decided in the context of other much larger east coast and Canadian ports for the period 1982-2000. Which commodities will be handled, what facilities are needed, and how must port business be conducted in order for the port to become competitive? What is the relationship between the Municipal Wharf, the P&W facility in East Providence, and marine facilities in Narragansett Bay owned by the Rhode Island Port Authority?

2. Performance assessments are needed for the Municipal Wharf. The productivity of berths, the degree of user satisfaction, the best utilization of terminal buildings, and methods to enhance revenue generation are important pieces of information about the terminal operations which are presently not available.

3. A better method of establishing prices is needed at the Municipal Wharf which includes the recovery of capital costs, and considers the impact of the rate change on revenues. A recent change in dockage charges was actually a price reduction for most vessels, although presented to the public as a means of increasing revenue.

4. Capital investment decisions in the port need to be accompanied by careful revenue projections and benefit analyses. Many east coast ports are witnessing massive investments in port facilities which often involve public funds. In some cases, these ventures are highly speculative in nature, rather than responses to well documented demands for new terminal capacity.

5. Marketing of port services needs to be greatly improved. This does not mean simply better public relations, but undertaking careful assessments of markets and clients to define the size of the total market, the fit between port facilities and market needs, forecasting shipping trends and technology, and fostering trade development.

6. Improvements to port operations are required, including dredging, rail service, quay maintenance and container cranes.

7. Area planning is required for the City owned Fields Point land, which surrounds the Municipal Wharf, as well as Providence Harbor and Narragansett Bay port facilities, to insure that most efficient and effective use is made of scarce waterfront land adjacent to marine terminals.

8. Supporting services and infrastructure need to be upgraded, including state transportation planning for intermodal freight handling, highway access to port facilities, maintenance, security and fire protection. A voice for port interests is required on matters of federal policy which could enhance or hurt the industry locally.

9. Financing of facility improvements at the Municipal Wharf has not been difficult until recently. About $14 million has been spent in the past decade on various construction and maintenance projects. However, with revenues unable to match total costs, and the financial condition of Providence leaving it with only a Baa bond rating, new expenditures are likely to be more difficult to make. Other port facility projects also will require additional capital which may not be available given high interest rates, and the present slump in international shipping. The Municipal Wharf will require an operating subsidy from Providence for the next several years, until revenues can increase again through marketing and service improvements which will lead to increased traffic.

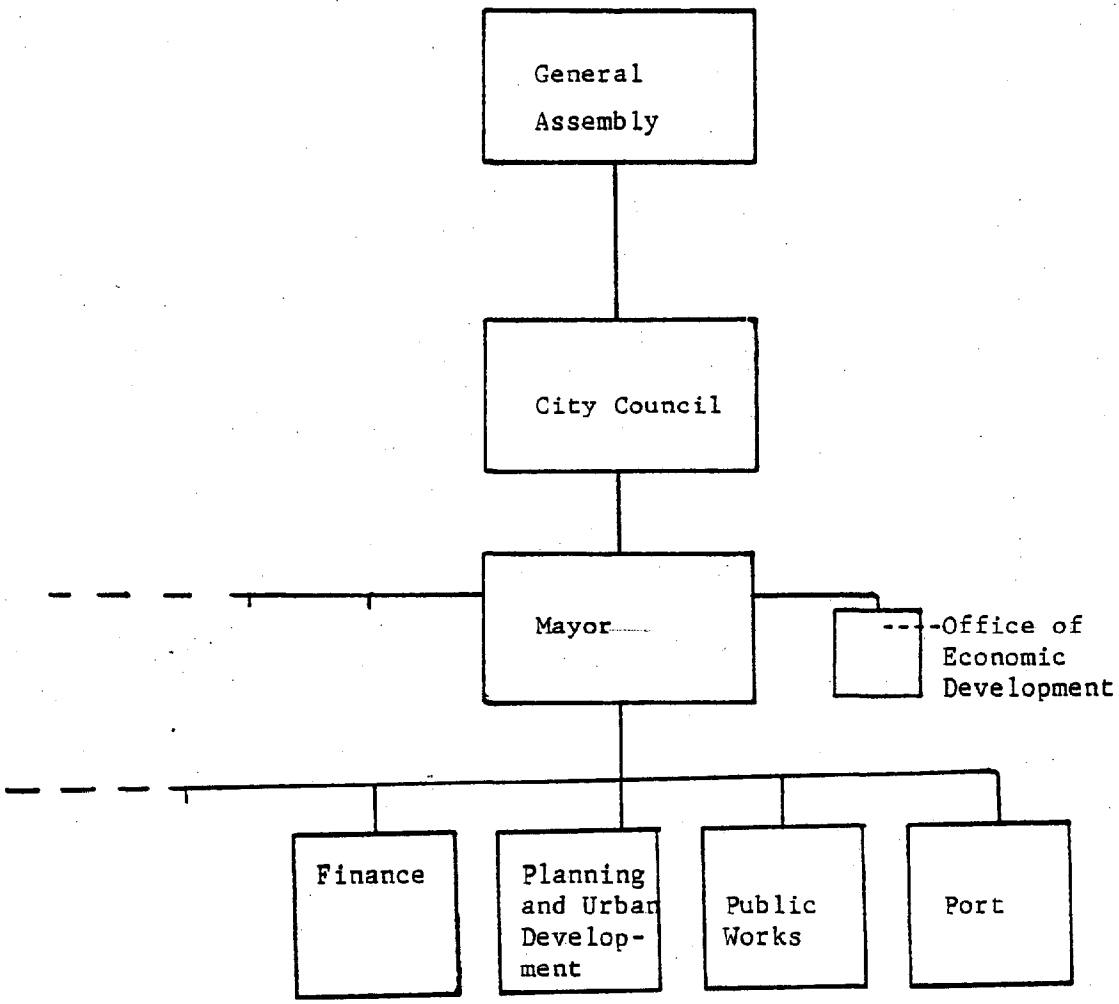
10. The decision making structure of the Municipal Wharf is characterized by uncertainty and awkwardness. The Port Director is hampered by the absence of sufficient power to create a neatly arranged self sufficient organization. Decision-making delays and cumbersome restrictions are frequent complaints about the activity of doing business with the Municipal Wharf. In addition, there is presently no organization with the charge of looking out for port industry interests in the Harbor as a whole.

ORGANIZATIONAL REMEDIES

The concensus among members of the Port Industry Working Group of the Harbor Estuary and Land Planning Advisory Committee favors the implementation of organizational changes to achieve improvements in these ten problem area. There are many possible changes, both in the location of responsibility for the Harbor (including the degree to which control of the Municipal Wharf would pass from the city to a state or private body), as well as the scope of concern about the industry and the depth of involvement in implementing solutions. As the nature of the proposed reorganization approaches that of a unitary, comprehensive port authority for Narragansett Bay, the difficulties and expense of implementation increase. The benefits of a dramatic change must be weighed against the costs, as well as the likelihood of success of other less ambitious choices.

A. Port Department

The home rule charter for Providence, scheduled for implementation in 1983, already contains a provision for establishing a port department in the city administration. Administration and budgeting for the Municipal Wharf would be consolidated, and the Port Department would have to compete for funds directly with other departments, rather than as part of the larger budget of the Department of Public Works. Billing procedures may be somewhat streamlined, but the port department would be required to negotiate for supporting services from the DPW and other city agencies (see Figure 1).



OPTION A
Port Department within existing City of Providence executive branch, as described in the Home Rule Charter to take effect in 1983.

Some progress could be made toward solving many of the ten port problems with the existing network which is responsible for the Municipal Wharf and environs. Much needed discussion of the role of Providence Harbor's port industry over the next twenty years could begin now with serious debate about the future of the Municipal Wharf. Performance analysis, improved pricing strategy and better capital investment decisions making procedures could be started now, either with the remobilization of existing personnel or some increase in skilled staff. Improvements could also be made now in marketing, port operations and area planning for Fields Point, although this too will require additional staff work. The port department could also take a leadership role in seeking improved supporting services, at least from the perspective of the Municipal Wharf. However, financing of port improvements is likely to be problematic, and to the extent that the port industry troubles are due to poor decision making arrangements, the port department will contribute little to their solution.

Since the port department is already included in the home rule charter, no additional action is needed to implement this option. Adequate financing of operations and physical improvements will still be required.

B. Rhode Island Port Authority Operation and Management of Providence Harbor

The Rhode Island Port Authority and Economic Development Corporation RIPA was created by the General Assembly in 1974 as an independent corporation with broad responsibilities and powers for tasking economic development through the acquisition, development and management of land for industrial and commercial purposes. It presently owns and manages industrial and marine facilities at Quonset/Davisville, Melville and Coddington Cove, all former Navy facilities.

The legislative findings for RIPA include a broad concern for port development throughout the state:

> (g) It is further found and declared to be the public policy of the state to encourage the expansion and development of the state's harbors and ports; to foster and improve the handling of waterborne commerce from and to any port of this state and other states and foreign countries; to seek to effect consolidation of the ports of this state and to promote a spirit of cooperation among these ports in the interest of the state as a whole; to initiate and further plan for the development of the ports of this state and to keep informed as to the present and future requirements and needs of the ports of this state; (GLRI 42-64-2)

There are five approaches which RIPA could take to begin fulfilling this legislative declaration, ranging from sponsoring regular meetings with the port industry on specific harbor management topics, to a total acquisition and operation program for all port facilities. These options are presented below, in the order of increasing complexity and RIPA control. They may be viewed in two ways: as distinct goals for RIPA involvement in Providence

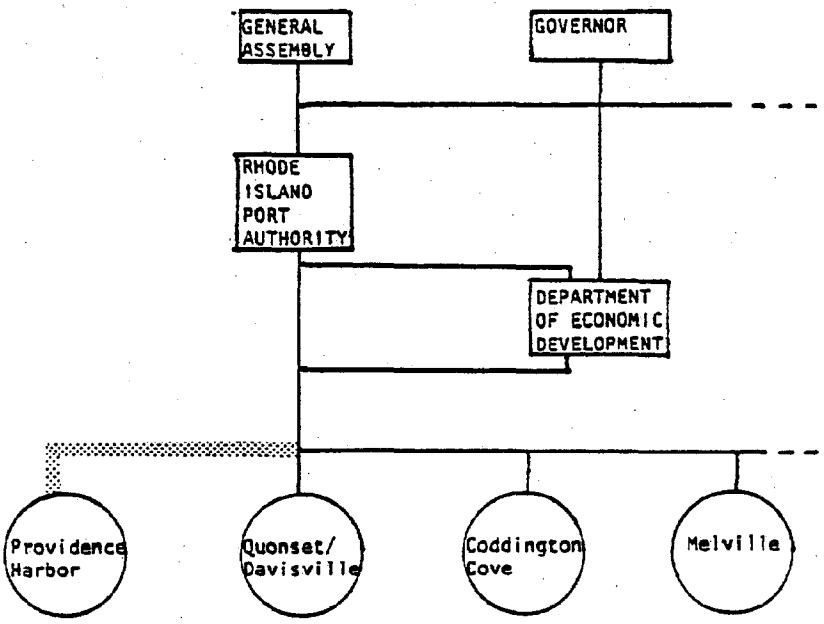
Harbor, or as a logical series of steps which gradually introduces RIPA to new responsibilities in the Harbor, possibly culminating in complete control if that is deemed necessary.

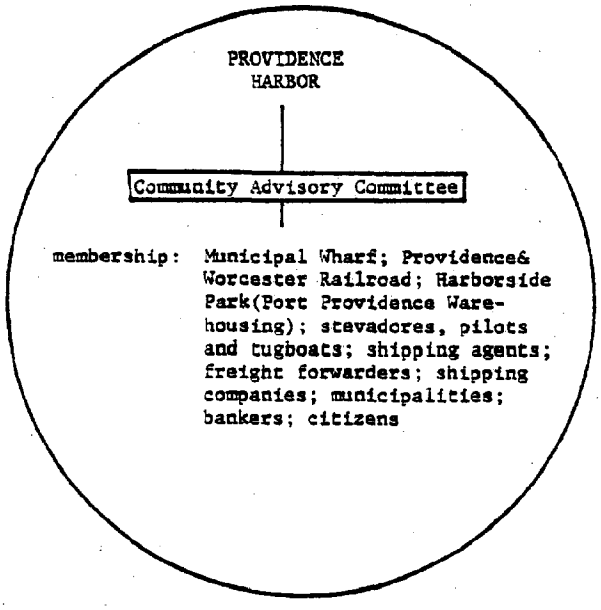
1. Trade Association/Advisory Committee: The Rhode Island Port Authority can and frequently does establish project advisory committees which are composed of a broad range of economic and community interest representatives. For planning and development studies at Quonset/Davisville, consultants, community leaders and public officials met regularly to hear progress reports and discuss major issues as work proceeded. In the case of Providence Harbor, monthly meetings could be held to discuss the ten port problems in more depth, and identify, analyze and make recommendations on major short and long term planning and management questions. The relationship of this group to RIPA is illustrated in Option B-1 as largely informal, since it requires the voluntary participation of the various groups listed in the enlargement of the Providence Harbor project shown at the bottom of the figure. However, it could be an important precursor to the successful establishment of a more aggressive RIPA role in Providence Harbor by demonstrating the depth of concern which exists, and serving as the focal point of an effort to organize sufficient support in the General Assembly for financing special projects through the Department of Economic Development. The RIPA can also use the committee to introduce new, or at least more modern port management concepts to encourage better decision making by port industry members.

2. Targeted Grants-in-Aid: In this arrangement, the RIPA would take a more active position in the Harbor by establishing a program of grants to industry operations, particularly the Municipal Wharf, to be administered through the Department of Economic Development specifically aimed at introducing better management and decision making practices (Option B-2). Each grant would be planned to solve a problem in an area where success or failure could be easily measured. Some of the topics which would be covered include: introducing a new data base for management decisions at the Municipal Wharf, labor productivity analysis for stevadores, market potential studies for specific proposals at existing or new Harbor facilities, and an assessment of rate-setting policies and their impact on the Municipal Wharf.

This grant-in-aid approach is frequently used at the federal and state level to achieve public goals by providing financial assistance to agencies or groups with direct responsibility for a particular problem. It does not include the direct exercise of control over a decision-making body or project manager, rather it depends upon exerting influence by improving the information available to such groups and the public.

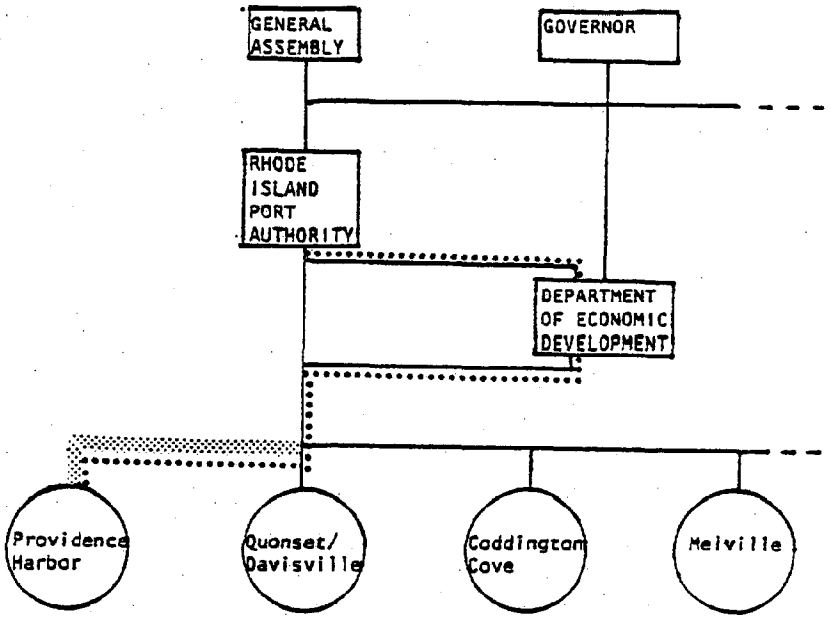
3. Grants-in-Aid/Narragansett Bay Port Study: An expansion of the grants-in-aid concept would place the Department of Economic Development squarely in the role of undertaking a thorough study of waterborne commerce opportunities and development needs in the Bay as a whole (Option B-3). A critical question would be defining the role of the "Port of Narragansett Bay" for the next twenty years and establishing priorities for the development and maintenance of port facilities. While avoiding the issue of exercising direct control over

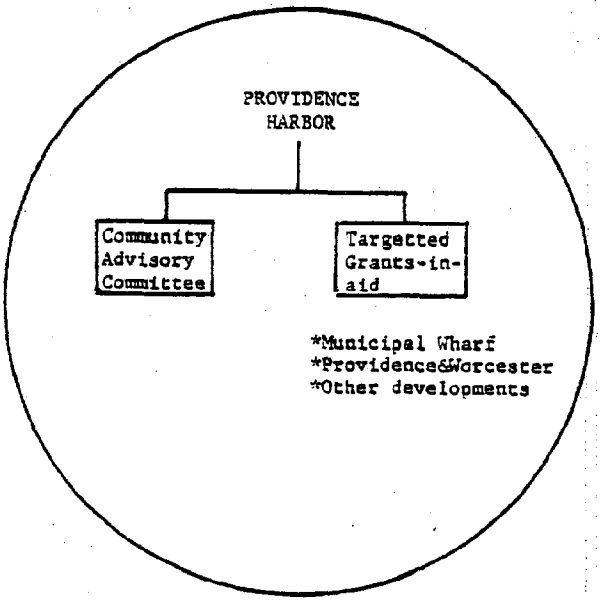




Option B-1
Providence Harbor as a Project of the Rhode Island Port Authority: Trade Association/Advisory Committee.

⁘ denotes informal relationship



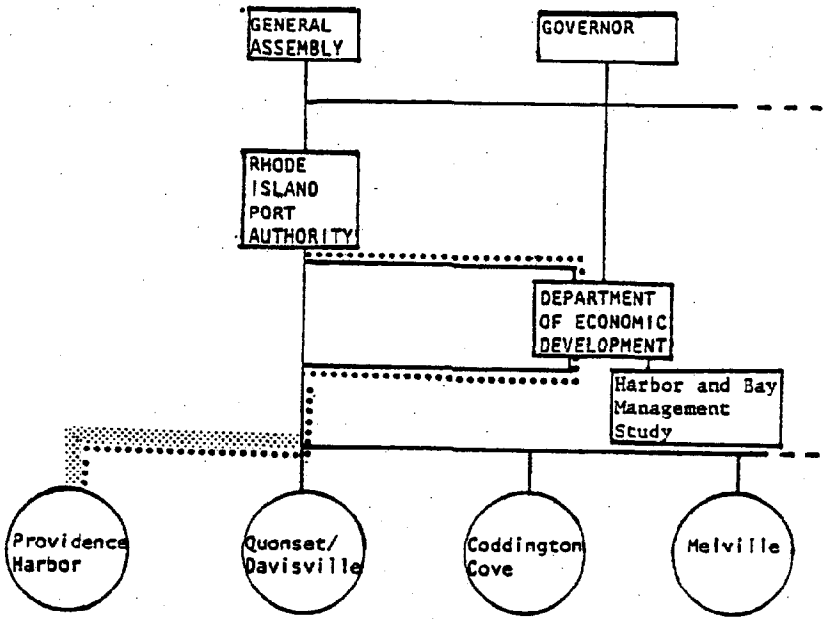


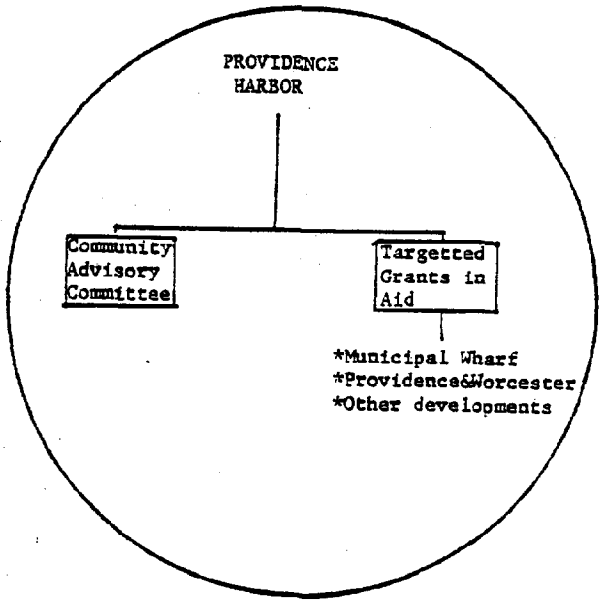
Option B-2

Providence Harbor as a Project of the Rhode Island Port Authority: Targetted Grants in Aid.

▒▒▒ denotes informal relationship

•••• denotes specific assistance on management, financing, marketing issues





Option B-3
Providence Harbor as a Project of the Rhode Island Port Authority:
Targetted grants in Aid, with full study of Bay port management.
:::::denotes informal relationship
••••••denotes specific assistance on management,financing,marketing issues

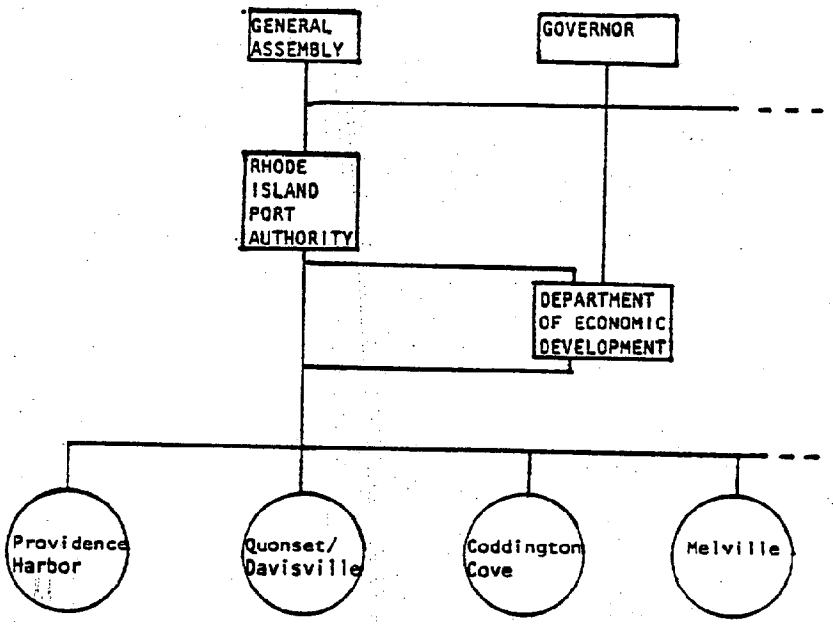
the behavior of terminal operators, industry entrepreneurs and public officials, this study program would placd RIPA and the Department of Economic Development in an excellent position to influence private investment decisions, guide and shape state policy pertaining to waterborne commerce and use its resources in financing and loan guarantees to achieve development goals. In addition, the state would finally have the factual basis it needs to determine the extent to which RIPA should initiate facility management arrangements with the Municipal Wharf and other terminals in Providence Harbor.

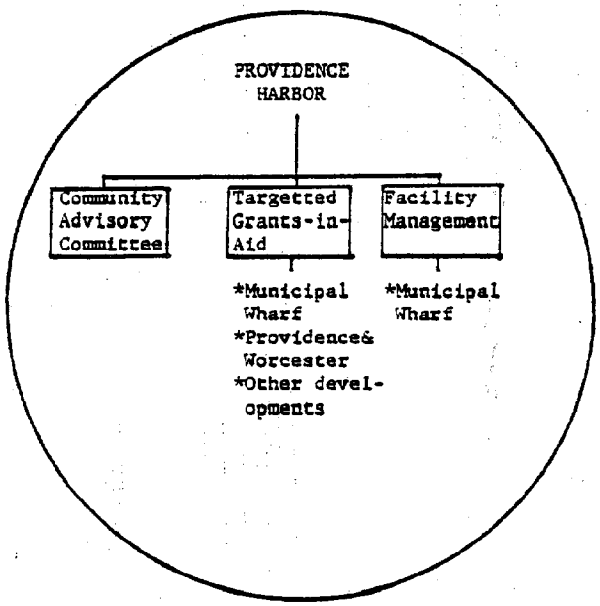
4. Limited Facility Management Arrangements: The Rhode Island Port Authority has had several years of experience in the daily management of the Quonset/Davisville industrial park as well as facility development planning for all of its waterfront industrial property. In the limited facility management concept, RIPA would become involved in operating part or all of the Municipal Wharf on behalf of the City of Providence. (Option B-4) Providence Harbor would become a formal project of RIPA, although the Authority would still not possess operational or strategic management responsibility over all terminals in the Harbor. The RIPA would be in a position to implement the findings of its management studies directly, rather than by attempting to exert influence with grants and good advice. The Providence Harbor project director would be expected to increase the amount of non-petroleum cargo handled and increase revenues to a level where the Municipal Wharf could support itself to a great degree. All of the planning, management and marketing tools at the disposal of the Department of Economic Development will be needed for these tasks.

The weak financial position of the Municipal Wharf will mean that some level of operating subsidy will be required. At present the Wharf generates about $700,000 in revenues, while its 1982 total costs (including interest and capital payments) is projected by the Coastal Resources Center at URI to be $2.2 million. Although Providence gets an additional $400,000 from lease payments on about 100 acres of land surrounding the Wharf, and tax revenue from port businesses on private land, these funds will not be available to RIPA. During the initial years of the new operating arrangement, RIPA would probably not be able to submit payments for use of the facilities sufficient to cover city costs.

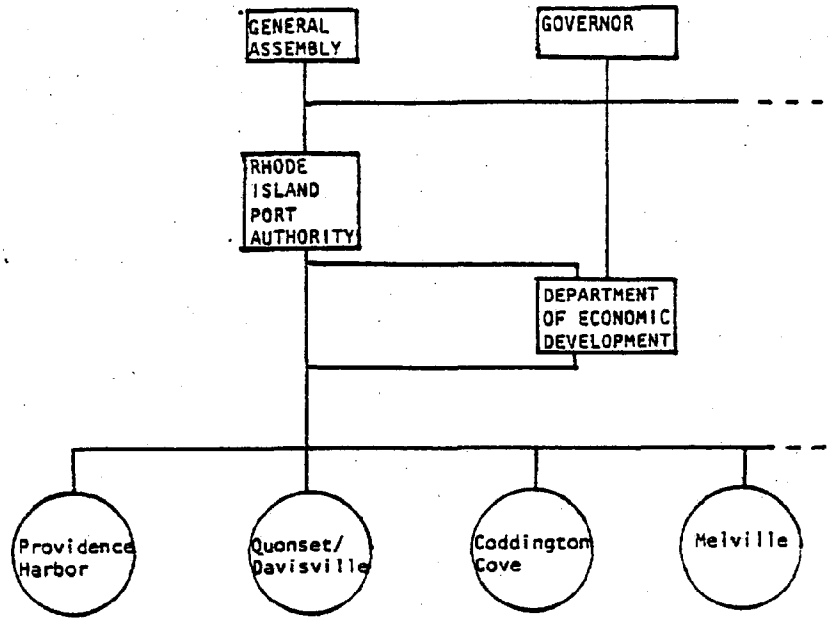
Another possible choice for the limited facility management option is the leasing of city-owned berths or sale of adjacent land to private operators. In this approach, lease payments would be expected to provide the city with a reasonable return, while the operator would be expected to finance site improvements.

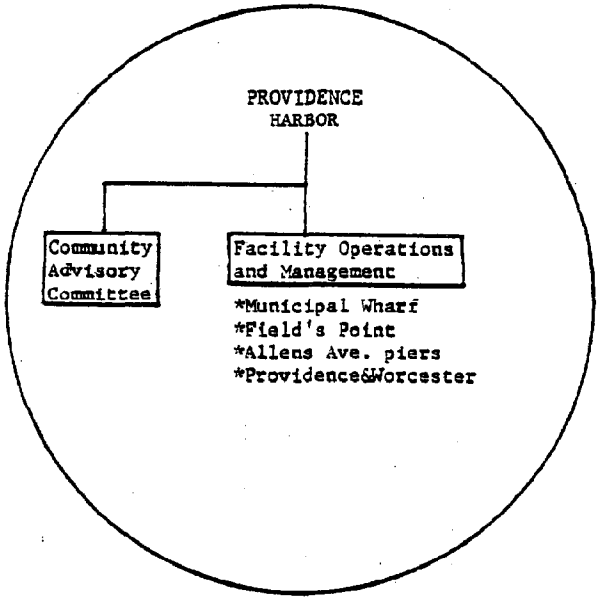
5. Full Harbor Facility Management: In this final, and most expansive level of involvement, the RIPA would seek to obtain complete control of both public and private marine terminals through operational agreements or purchase. In essence, RIPA would be the sole port operator in Narragansett Bay, and the primary agent for planning, developing, marketing and administering non-petroleum facilities (Option B-5). Unlike the other options available to RIPA, this proposal could not be implemented in one step due to its magnitude and risk. RIPA would first need a plan of action which specified precisely how the port industry would be improved by the dramatic steps, establishes priorities, and identifies the financial resources which could be tapped to





Option B-4
Providence Harbor as a Project of the Rhode Island Port Authority: Limited Facility Management.
——denotes formal relationship





Option B-5
Providence Harbor as a Project of the Rhode Island Port Authority:
Full Facility Management.
——denotes formal relationship

pay for the program. In addition, a major effort would be required to obtain a sufficiently skilled staff to perform operations management and strategic planning. Assuming acquisition was the preferred route, RIPA would have to begin immediately to boost revenues to begin to pay off the massive debt it would incur. If operating agreements were obtained, state subsidies would still be required to cover the period when terminals were performing below the level where costs were fully covered. It is conceivable that other arrangements which place constraints upon private operators and the Municipal Wharf for relatively low cost could be developed which still achieve some measure of RIPA control over most facilities.

C. and D. Independent Providence Harbor Authority, State (C) or Municipal (D)

In these options, a new entity, separate from the Rhode Island Port Authority, but similar in structure and powers, would be created to govern the port industry. It would be faced with the same array of choices for level of involvement described for RIPA, with the exception that its perspective would be more narrowly focused, and that the resources which could be brought to bear on the problems of the industry would be quite limited in the near term.

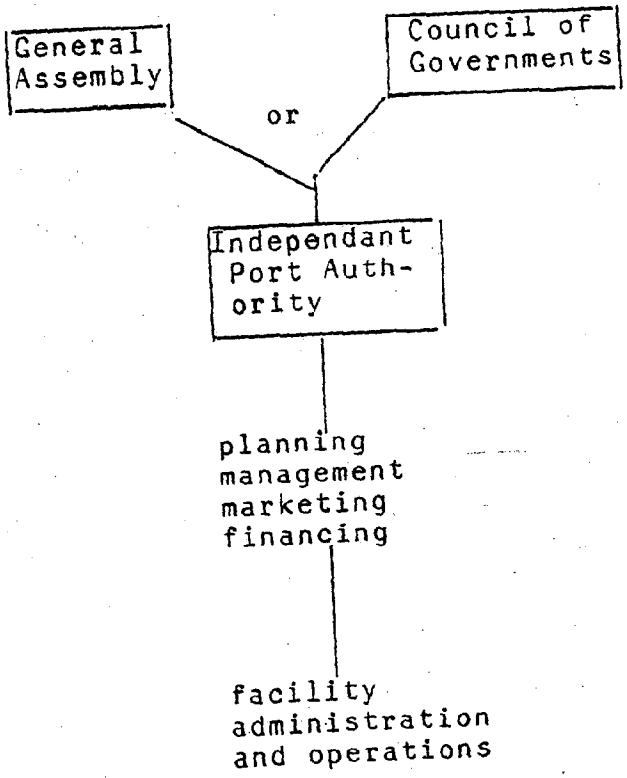
A new state authority would be required in the event that RIPA could not be encouraged to become involved in Harbor planning at more than a rudimentary level, and the industry determined that a more centralized and independent structure for the industry was vital to its survival, hence justifying the effort needed to seek approval and implementation.

A municipality organized Harbor authority, similar to a council of governments or a regional school district, would represent a response by communities to a lack of state initiative in the Harbor. Its organization would be similar to the state authority (Options C and D), with the exception that it would be even further removed from state resources and powers as it carried out its mission as defined by the member communities. Several questions about the effectiveness of this form of action need to be addressed, including the limited financial resources available to even supply proper staffing, the lack of expertise in port management, the isolation from state resources, and in the case of the Municipal Wharf at least, the fact that the municipal approach has not been particularly satisfactory to date.

PORT INDUSTRY WORKING GROUP RECOMMENDATIONS

The Rhode Island Port Authority was determined to be the best candidate for taking on the task of managing and planning for the port industry in Providence Harbor, based upon its broad powers and responsibilities, its role in developing other port facilities in Narragansett Bay, its state-wide perspective and access to economic development resources.

The other options were found to have drawbacks which would impede the success of any new management program. The City Port Department, when established, will be an important step forward in the consolidation of port functions. Many of the problems which the industry faces could be addressed to some extent by a Port Department with adequate financial resources. However, the Department will have to compete directly with other city agencies for funds and will be subject to the same decision-making procedure which has been the source of



Options C and D
Independant Port Authority, either state run, or formed by a group of municipalities, level of involvement would be similar to Option B, levels 1-5.

In recommending the creation of new management institutions, it must be recognized that the ultimate test of the organization is its performance, which depends a great deal upon the talents and motivation of those working for it.

It should be anticipated that a thorough and objective analysis of the problems of port industry development in Narragansett Bay could conclude that the biggest port industry problem in Narragansett Bay is an oversupply of under-utilized piers and wharves, and might recommend a reduction or consolidation of public and private facilities, rather than their expansion. Another possible recommendation might be to subcontract terminal operations to private firms in exchange for a fixed fee which covers the cost of publicly financed capital improvements. A good decision-making process would require serious consideration of such an analysis, despite its pessimism and potential unpopularity with the port industry. On the other hand, a more detailed assessment of the benefits which the region receives from port services could reveal important savings which accrue from a terminal operation which does not appear to be financially sound. Hence public sector involvement in seemingly unprofitable ventures might be strongly endorsed by an independent evaluation.

At present, the port industry in Providence Harbor cannot learn from these analyses, because they have not yet been commissioned. Even if they had been completed, there is presently no single decision-making body in a position to utilize their results. The Port Industry Working Group believes that it is essential to establish a mechanism which has specific responsibility for addressing and solving port industry problems, and that an effective structure can be created from institutional resources which are close at hand, and whose capabilities are well understood.

Preliminary Report from the URI Advisory Group to the Narragansett Bay Water Quality Management District Commission

August 17, 1981

Introduction

In May of this year, the Chairman of the Commission asked Dr. John Knauss, Dean of the URI Graduate School of Oceanography, for advice from the University's research community on technical questions regarding water quality management decisions in the upper Bay area. Dr. Knauss responded by forming a URI Advisory Group to the Commission which is chaired by Stephen Olsen, Director of the Coastal Resources Center. The Advisory Group (see Attachment A) was asked to address the following three topics and to prepare a preliminary response by August. The questions are:

1. What are the existing and forthcoming data on the upper Bay ecosystem which can be utilized to assess the impact of various municipal waste water treatment strategies?

2. How can such information be integrated with the many ongoing design engineering efforts and used to prioritize alterations to waste water collection and treatment facilities?

3. What are meaningful goals for improvement to upper Bay water quality that could be utilized when evaluating alternative engineering options?

In the brief time available to us, we have focused on questions 1 and 2. Question 3 can be addressed only after a more complete analysis has been made of the sources and fates of the many pollutants that presently cycle through the upper Bay ecosystem. During the past six weeks, we have worked on two fronts. Dr. Kelly and Don Robadue have reviewed many of the voluminous studies concerning the Providence sewer system and the need to upgrade it. The Chairman, Dr. Pilson and Dr. Hoffmann have attempted to review the various aspects of water pollution in the upper Bay. We believe that it is important that the Commission be familiar with the characteristics of the ecosystem we all hope to improve and to understand how the Commission's efforts may affect the quality of upper Bay waters.

In conformance with the recommendations of the Governor's task force, the advisory group assumes that the Commission will, as its first priority, ensure that the Fields Point treatment plant will in the future be capable of treating wastes at a secondary level as stipulated by EPA regulations. We have not attempted to address the complex and expensive task of design engineering and construction required to assure the long-term treatment capabilities of the Fields Point plant. We have focused rather, on the Providence sewer system as a whole and the less well-understood problem of the combined sewer overflows (CSOs) which presently place very significant volumes of untreated wastes in the Providence River.

Aids to Decision Making on the Providence Sewerage System

We conclude that when the Commission takes over the Providence sewer system and the ongoing engineering projects for improvements to the system, it should, as a priority, take steps to accomplish the following:

(a) establish baseline water quality conditions in the receiving Bay and river waters.

(b) determine the present impact on water quality of existing discharges from the CSO's.

(c) develop the appropriate tools that will enable the Commission to predict and quantify the expected benefits from a management strategy or engineering alternative.

Efforts to date to model the Providence sewer system and receiving waters have been appropriate for the planning efforts undertaken through the 208 Program and the facility planning efforts for the sewer system. We believe, however, that good engineering and management practice strongly suggests that a more advanced predictive capability needs to be developed to help integrate and evaluate the design engineering and future management strategies.

The first focus for efforts to better integrate an understanding of the Providence sewer system and predicted improvements to the receiving waters could be the Providence-Woonasquatucket-Moshassuck river system above the Fox Point Hurricane Barrier. A short-term sampling program of storm events complemented by long-term monitoring in this area, perhaps by the USGS, should provide an adequate data base for modeling this relatively small and self-contained system. Experience gained here could be applied to tackling more complex problems elsewhere. We believe that these recommendations are fully consistent with those of the 208 Program and the conclusions being drawn by many of the engineers presently working on the CSO problem.

Problems very similar to those that will be faced by the Commission when it takes over the Providence sewer system are being addressed by similar groups in other cities. It will be important for the Commission to keep abreast of these efforts so that it may benefit from experience elsewhere. It is clear that an aggresive maintenance program will be crucial to a successful sewer system management program. We suggest that early on in the process of funds allocation, the Commission cost out their long-term operation and maintenance program. The success of a maintenance program may accomplish as much for the long-term improvement in the quality of receiving waters as any simple alteration to the structure of the sewer system.

Summary Findings on Pollution in the Upper Bay Ecosystem

Our review of research on topics that directly relate to developing a better understanding of pollution in the upper Bay makes it clear that a wealth of information exists and that important projects are underway or scheduled to begin in the next two years. This research and monitoring, however, is conducted by various agencies and individuals for different purposes with minimal efforts at overall coordination and integration. We feel that it is fully in keeping with the Commission's role that it assume a position of leadership in the coordination and integration of research and monitoring that relates to water quality management in

the upper Bay. The research community would welcome a framework of management questions and priority informational needs. We are not suggesting that the Commission should become a research agency, but rather wish to point out that the Commission could provide a focus for the many ongoing activities that directly relate to the Commission's own responsibilities.

Ongoing and proposed research and/or monitoring efforts relevant to upper Bay pollution problems are being undertaken by the Dept. of Environmental Management, engineering firms working on aspects of the Providence sewer system, the EPA's Narragansett Research Lab, the United States Geological Survey, the Office of Marine Pollution Assessment in NOAA, the R.I. Statewide Planning Program, the Marine Ecosystems Research Laboratory (MERL), the Coastal Resources Center, the URI Dept. of Ocean Engineering, and the URI Sea Grant Program. The following summarizes some of the information and projects that we believe may be of particular interest to the Commission.

1. In 1978, EPA Region 1 funded the Coastal Resources Center to produce a summary and evaluation of all information pertaining to the water quality of upper Narragansett Bay (Olsen and Lee, 1979). This document provides, in non-technical language, a detailed synopsis of this topic. The Center has also produced An Interpretive Atlas of Narragansett Bay (Olsen, Robadue and Lee, 1980). This well-illustrated volume gives a comprehensive overview of our present understanding of how the Bay functions as an integrated ecosystem. Both volumes should be useful to Commission members and staff.

2. Thanks to a one-year survey of pollution gradients in the Bay and some major pollutant sources, that was funded by EPA Region 1 and conducted by MERL in 1979-1980, we now have a more detailed understanding of the Bay's water quality characteristics. However, several basic questions remain unanswered. The MERL survey was conducted at a time when the Field Pt. Plant was operating moderatly well. The survey provides the following major findings:

   (a) The MERL survey of pollution nutrient sources provides data on inorganic nitrogen, phosphate and silicate in the effluents of the three sewage treatment plants, CSO #002 and the Blackstone and Pawtuxet Rivers. Very high nutrient levels cause the eutrophic conditions in the Upper Bay that is expressed by high BOD and widespread anoxic (no oxygen) conditions. When the MERL survey data is combined with preliminary data for organic and particulate nutrients, the conclusion is that the two rivers contribute about as much nitrogen and phosphate as the effluents from the Fields Point plant. We do not know the significance of inputs from the other streams and rivers, the approximately 90 CSO's or storm runoff. The major terms for nutrient inputs, however, are known.

   (b) As expected, due to relatively efficient chlorination processes at all sewage treatment plants, the sources of coliforms are not treated effluent waters. Here again the rivers and CSO's appear to dominate as the major sources. The Pawtuxet is particularly important.

(c) The Fields Point plant is the major measured source for copper. Lead and cadmium were not measured for Fields Point during the survey.

(d) Organisms living in and on the bottom of the Bay are known to play an important role in recycling nutrients and some pollutants back into the overlying waters. Very preliminary data for the upper Bay suggests that this process is important in maintaining high nutrient levels in this area.

(e) The MERL biweekly survey, which was conducted along a transect from the head of the Bay to the Sound, confirms that the upper Bay is the primary source of all major pollutants to the Bay ecosystem. The waters above Conimicut Point are characterized by low oxygen levels and high concentrations of metals, petroleum and other pollutants. In the Providence River, zooplankton populations are depressed and the growth of the animals that are present is slower than in comparable non-polluted areas.

4. Experiments using microcosms of Narragansett Bay at MERL provide exciting insights into the possible results of various management strategies.

-- One set of experiments suggests that the highly polluted sediments in the upper Bay would not severely pollute overlying waters if waterborne sources of pollution were stopped.

-- A future set of experiments could test a hypothesis that the silicate to nitrogen ratio in the Bay waters determines whether very small flagelate plankton or diatoms will dominate the plant plankton (phytoplankton) community. The flagellates that dominate in the Providence River may be unsuitable as food for zooplankton (animal plankton), fish and shellfish. Further down-Bay diatoms dominate and support abundant fish and shellfish populations. For diatoms to dominate the silicate to nitrogen ratio must be around 1:0.4 (rather than 1:1 or greater as in the upper Bay). It might be possible to increase the range of diatoms by adding silicate to sewage treatment plant effluents.

5. According to Dr. Phelps, of the EPA Narragansett Research Lab, toxic effects from most pollutants are seen when concentrations in the water are 3 to 5 the levels found in clean environments. Metals and several other pollutants exceed this concentration factor in the Providence River; copper, for example, is 20 times above ambient levels.

6. EPA Region 1 has funded Dr. Malcolm Spaulding (URI Ocean Engineering) to update and improve existing water quality hydrodynamic models for the upper Bay. Pooling a variety of funding sources, Dr. Spaulding is presently conducting an intensive sampling program in a transect across the Bay off Gaspee Point. This will provide badly needed data for future modeling. At present, all hydrodynamic models rely primarily for their data or information gathered in the early 1930's.

-- Dr. Spaulding's new data and models provide an important tool for water quality management in the upper Bay.

-- Preliminary estimates are that the flushing rate of the Providence River is approximately 10-15% per day.

7. The NOAA Office of Marine Pollution Assessment has funded Dr. Eva Hoffman at URI to conduct a major three-year study of petroleum pollution levels in urban runoff. Dr. Hoffman is conducting her research in the Providence area and will provide very important data on pollutants, including nutrients, in storm runoff.

8. One of the principal characteristics of pollution in the upper Bay is pervasive eutrophication due to the large discharges of nutrients to the area and a subsequent chronic problem of low oxygen levels in the Providence River. The scientific community is not convinced that the low oxygen conditions can be significantly improved by efforts to reconstruct and upgrade treatment facilities in the Providence area since primary and secondary treatment do not remove these constituents from the treated waters. Efforts to upgrade the Providence sewer system, particularly to correct the CSO discharge problem, may significantly reduce coliform levels in the Providence River. Metals and organic compounds, some of which are extremely toxic, will be most effectively checked at their sources, before they enter the sewer system.

Attachment A

The URI Advisory Group to the Water Quality Commission

Stephen Olsen, Chairman	Director, URI Coastal Resources Center
Dr. Eva Hoffman	Marine Scientist, Graduate School of Oceanography
Dr. William Kelly	Chairman, Dept. of Civil Engineering and Director, R.I. Water Resource Center
Dr. Michael Pilson	Professor of Oceanography and Director of the Marine Ecosystem Research Laboratory
Donald Robadue	Marine Resources Specialist, Coastal Resources Center

University of Rhode Island, Narragansett, RI 02-1207
Division of Marine Resources
Marine Advisory Service, Coastal Resources Center
(401) 792-6211

To: HELP Committee

From: Donald Robadue, Ellen Deason, CRC

Date: July 8, 1982

Re: 14 July Meeting

Selecting Use Priorities for Providence Harbor

During the last four sessions we have focused on the problem of water quality and its relationship to shore and water uses. The single-most important financial investment the state and federal government is making in the Harbor is the reconstruction of the Field's Point sewage treatment plant, along with other physical and management improvements to the Providence sewage system. In the entire 2160 km^2 drainage basin which sends discharges eventually to the Harbor, well over $400 million in municipal sewage treatment projects has been proposed. The current state water quality plan for the Providence River states that this receiving water body will be in compliance with its goal once the effluent limitations for all point discharges are met. Unfortunately, federal support for its facility construction grants program is waning with more emphasis placed on demonstrated improvements. In addition, national industrial pretreatment requirements are likely to be considerably weakened. It has become important to discuss facility construction priorities, industrial pretreatment requirements and many other aspects of controlling point and non-point discharges in terms of much more specific goals for marine water use. This in turn requires that we utilize all available information about the sources, fates, and effects of pollutant discharges on Narragansett Bay, press for additional facts where needed, and begin to critically examine the benefits and losses to the State from various clean-up options.

The Special Area Planning Project is designed to enable the Coastal Resources Management Council to play an active role in the quest for a water quality improvement strategy for the Harbor and Bay. As we have already discussed, the assignment of specific use priorities to portions of the Seekonk and Providence Rivers quickly leads to some dramatic implications in water quality planning and regulation of discharges, as well as the importance which we should place on non-pollution concerns. With that fact in mind, we would like your assistance in a preliminary identification of use priorities in various sections of the Harbor and Upper Bay during our meeting on July 14. The following questions, as well as material we have distributed, or discussed in previous sessions, are intended to guide your thinking. The basic categories are: shellfishing, shellfish habitat, fish habitat, swimming, boating, shore uses such as residential, commercial and port.

1. Should water quality efforts be directed at protecting access to existing shellfishing grounds south of Conimicut Point, or increasing access northward to the lower Providence River?

2. Should swimming be possible as far north as Sabin Point or Field's Point? Would very stringent seasonal disinfection requirements be in order?

3. Should pollution control efforts be focused on maintaining good shellfish habitat, and how far north should these efforts be extended?

4. Is reduction of odor and better aesthetics, increased disinfection, or both desirable north of Pawtuxet Neck/Sabin Point, to support recreational boating?

5. In terms of disinfection policy, if a choice between good fish and shellfish habitat, or safe swimming and boating had to be made, which is more important?

6. Which foreseeable uses of the shore and water north of Pawtuxet Neck/Sabin Point in the Seekonk River, as well as Mushassuck and Woonasquatucket, are likely to be most limited by the present water quality conditions?

7. In which use priority topics would additional information be most useful to you in making a decisions on a designation?

8. If it were essential to the use of a specific portion of the estuary, should the state establish stricter discharge limits?

9. If it did not interfere with the specific coastal and water use goals for the Harbor and Bay, should the state be more flexible in permitting certain discharges?

10. In your view, how valid and important is the problem of continued degradation of the waters of the entire Narragansett Bay from Providence River sources?

11. Given your understanding of the present and potential economic condition of the state and the region, how important is it to make clearly stated tradeoffs between the cost of clean-up and the benefits to be derived from it? Which side should be favored?

The discussions of water quality which we are holding as part of the Special Area Planning Project, and the identification of use priorities within that framework, is the first step in the development of draft proposals for consideration by the Coastal Resources Management Council. The process of plan review and adoption will include many state and federal agencies as well as the public. The HELP Committee's participation during the period of information gathering and idea formulation has been most valuable in producing new ideas, and providing an early test of the strength and weakness of specific proposals.

DR/ED:dzc

PLANNING FOR WATER QUALITY IMPROVEMENTS IN UPPER NARRAGANSETT BAY AND ITS TRIBUTARIES

A draft report to the Harbor Estuary and Land Planning Advisory Committee of the Coastal Resources Management Council

June 1982

Prepared by Ellen E. Deason
Coastal Resources Center
Graduate School of Oceanography
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Donald Robadue, Jr., Project Coordinator

The preparation of this report was financed in part by a grant from the National Oceanic and Atmospheric Administration under the provisions of the Coastal Zone Management Act of 1972 (Public Law 92-583)

INTRODUCTION

Since the Clean Water Act amendments of 1972, a national construction project has been working toward the ambitious goal of "fishable, swimmable waters by 1983." Water quality improvements in the Providence River and many other estuaries nationwide will clearly not meet that deadline, and it is time to reassess the goal as well as the time frame. Until recently, treatment facilities have been designed to meet federal effluent standards on the assumption that it is too difficult to base the design of facilities on predictions of actual water quality improvements. However, applications for federal construction grant funds must now include a cost-benefit analysis. This means that funding will be based, at least in part, on the projected benefits resulting from improved water quality rather than the previous criteria of effluent standards. "Benefits" will be measured by expanded or new uses which will be possible in the cleaner water resulting from the treatment facility. Such analysis requires information on the pollutants interfering with the desirable uses, their sources, their behavior in the estuary and the response of the ecosystem to changes in the loadings of these pollutants. Although there are major gaps in our knowledge of most of these areas, pulling together the available information can point to priorities for both treatment needs and additional information.

These water quality issues have been under consideration by the Harbor Estuary and Land Planning (HELP) Advisory Committee which was established in January 1982 to assist the Urban Waterfronts Subcommittee of the Coastal Resources Management Council (CRMC) in its effort to develop a Special Area Management Plan for Providence Harbor. The purpose of this proposed plan is twofold. First, the CRMC seeks to foster a concerted effort for waterfront revitalization. Secondly, the CRMC desires to assure a careful balance of public and private uses in the area in order to achieve the goals of increased recreational opportunities, port development, compatible shoreline uses and improved water quality. The HELP Committee has approached the topic of water quality by examining several management questions which consider the desirability and feasibility of potential uses in the Providence River and Upper Narragansett Bay.

Water Quality Planning and Management Questions:

1. Would it be desirable to expand shellfishing opportunities in the Upper Bay and Providence River? What water quality improvements would be necessary to achieve this goal?

2. How is water quality related to finfishing opportunities in the Upper Bay, Providence River, and Seekonk River?

3. Is water quality interfering with swimming in the Upper Bay or the Providence River?

4. How does water quality limit recreational boating in the Upper Bay, Providence River, or Seekonk River?

5. Current state management establishes water quality goals for stream segments and subareas of the bay and regulates effluents to achieve those goals. What are the consequences of this approach in terms of "down stream" cumulative effects?

1. WOULD IT BE DESIRABLE TO EXPAND SHELLFISHING OPPORTUNITIES IN THE UPPER BAY? WHAT WATER QUALITY IMPROVEMENTS WOULD BE NECESSARY TO ACHIEVE THIS GOAL?

Water Quality Goals for Shellfishing

There are extensive shellfish beds in the upper bay including some of the richest in Narragansett Bay. The beds in the lower Providence River north of Conimicut Point were completely closed to shellfishing in the early 1950s and since 1969, the area between Conimicut Point in Warwick and Prudence Island has been opened on a conditional basis only (Figure 1). Closures have varied from 16 to 100 percent of the year as shown in Table 1. An approved shellfishing area must meet legal criteria established by the Food and Drug Administration and incorporated into RI's water quality classification system. The major obstacle to meeting this standard in the Upper Bay is high concentrations of total coliform and fecal coliform bacteria, which are used as an indicator for bacteria and viruses.

The combined sewer overflows (CSOs) in Providence, Pawtucket, and Central Falls are regarded as the major reason for the closures. Since substantial rainfall causes dilute but untreated sewage to overflow into the Providence River and tributaries, Upper Narragansett Bay is closed to shellfishing for 7 days following 0.5 to 1.0 inch of rain in Providence in 24 hours and for 10 days following 1.0 or more inches. (Prior to 1972, closures were for 5 days following 0.75 inches). In December of 1978, the failure of the Field's Point sewage treatment plant caused a permanent emergency closure of the entire Upper Bay. Due to repairs to the Field's Point plant which restored primary treatment with disinfection and the dry winter of 1979-80, the area was reopened conditionally in February 1980 (lower portion) and July 1981 (upper portion). The closure line was again moved south last December at the start of the wet season, but DEM anticipates it will be moved back to Conimicut Point in June or July.

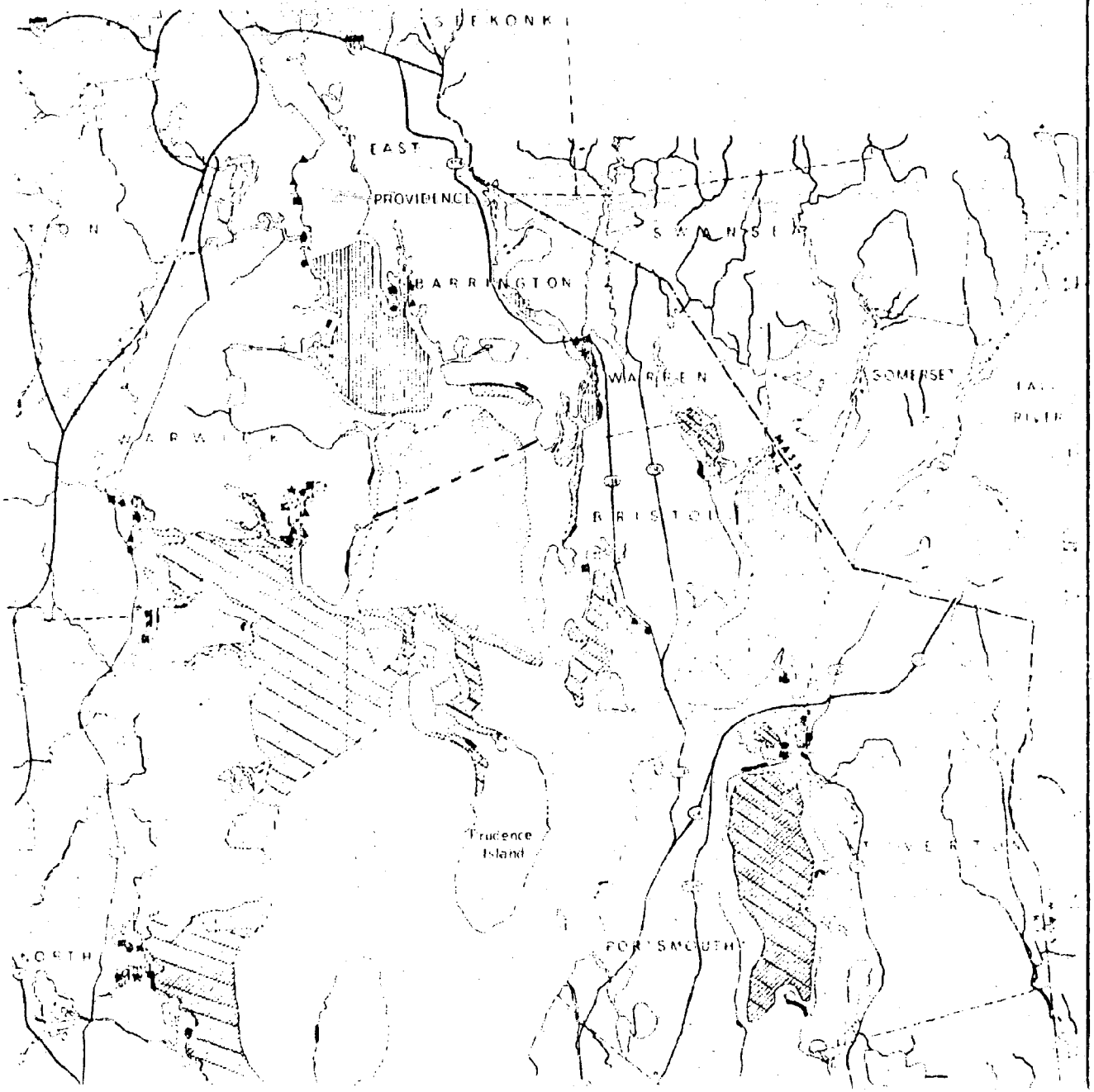
Increased access to shellfishing would be one of the most visable indications of improved water quality in the Upper Bay. It is also the use that requires meeting the most stringent water quality requirements. A range of possible goals for shellfishing in the Upper Bay include:

1. opening the permanently closed beds north of Conimicut Point
2. opening the area between Conimicut Point and Prudence Island on an unconditional basis
3. reducing the number of closure days in the conditional area
4. maintaining the status quo
5. closing additional areas
6. opening additional areas for harvesting followed by depuration

Coliform Problem: Sources and Proposed Abatement

As a first step toward extending shellfishing in the Upper Bay, coliform concentrations would need to be lowered. Sewage treatment plants are presently required to chlorinate effluent year round. When they are functioning properly, they should not be a source of coliforms. CSOs are

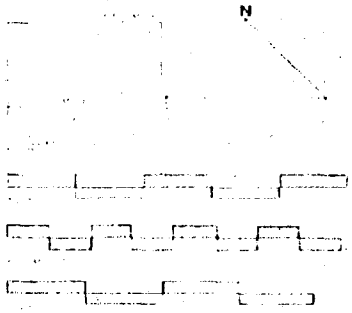
Figure 1. Shellfish Beds



State of Rhode Island

208 Areawide Water Quality Management Plan

Shellfishing and Recreational Activities in Rhode Island Coastal Waters



Legend :

- Open to shellfishing
- Open on a conditional basis---winter closure line
- Closed June 1-Sept 30 due to boating activity
- Permanently closed

TABLE 1.
Shellfish Closures in Upper Narragansett Bay "Conditional Area" Between Conimicut Point and Prudence Island

Year	Percent of year closed to shellfishing
1969	22
1970	16
1971	27
1972	72
1973	67
1974	49
1975	55
1976	50
1977	71
1978	74
1979	100
1980	61
1981	51

Source: R.I. Department of Environmental Management

suspected to be a major coliform source. Providence has 65 overflows which discharge into the Seekonk, Woonasquatucket, Moshassuck, West and Providence Rivers. Sampling conducted by URI's Marine Ecosystem Research Laboratory (MERL) indicated that the Blackstone River, which receives overflows from 8 Central Falls and 22 Pawtucket CSOs, is a major source of fecal coliforms.[1] The average concentration at the mouth of the Blackstone during the dry year of 1979-80 was 6400 most probable number (MPN) of fecal coliforms per 100 milliliters (/100ml) and concentrations ranged as high as 23,000. (The standard for shellfishing is 15 MPN/100 ml). Concentrations of coliforms decreased rapidly down the Providence River (Figure 2), probably because they do not survive well in salt water. Below Warwick Point they were not detectable. The MERL study found that the Pawtuxet River also contributes high concentrations of coliform (mean 1100, maximum 16,000 MPN/100 ml in 1979-80), although there are no CSOs in its drainage basin. These high values may result from urban storm water runoff or improperly chlorinated effluent.

One difficulty in planning for a reduction in coliforms is that measuring an improvement in coliform levels is complicated by great variations in their abundance. Routine sampling is conducted by DEM once a week in the Upper Bay, but because of changes in tide height and rainfall it is difficult to detect trends except by examining long term records. For example, there has been no dramatic lowering of coliform concentrations since the repairs to the Field's Point Plant. There are, however, fewer of the sporadic extremely high values which occurred when sludge was washed out of the broken down plant during wet weather.

Lack of knowledge of estuarine circulation is another problem. Unlike a river, where downstream concentrations of pollutants are diluted by stream flow, tidal movements tend to concentrate substances in the upper reaches of the estuary. Currents and wind patterns complicate the circulation pattern so that concentrations and distributions are not easily calculated. In the case of coliforms, concentrations are also affected by die-off, which is related to temperature and therefore occurs at different rates depending on the season. A computer model of Upper Bay circulation currently being developed by Dr. M. Spaulding of URI should aid in predicting changes in the amounts and distributions of coliforms which would result from reducing various sources.

Plans were prepared to treat the overflows from Providence CSOs as part of the Providence Facilities.[2] Nine satellite treatment facilities were proposed which would consolidate overflows and provide primary treatment and disinfection. Design work is proceeding on CSO facility #9, at Field's Point, which would treat combined sewage and runoff from a large drainage area in South Providence. Study of area #2 has indicated that approximately 70 percent of the area is not composed of combined sewers, but rather separate sanitary and storm sewers. Wet weather overflows were observed at only 3 or 14 overflow points in area #2. Instead of the originally proposed treatment facility, modifications to the sewer lines which would prevent overflows and allow later treatment at the sewage treatment plant are now under consideration.

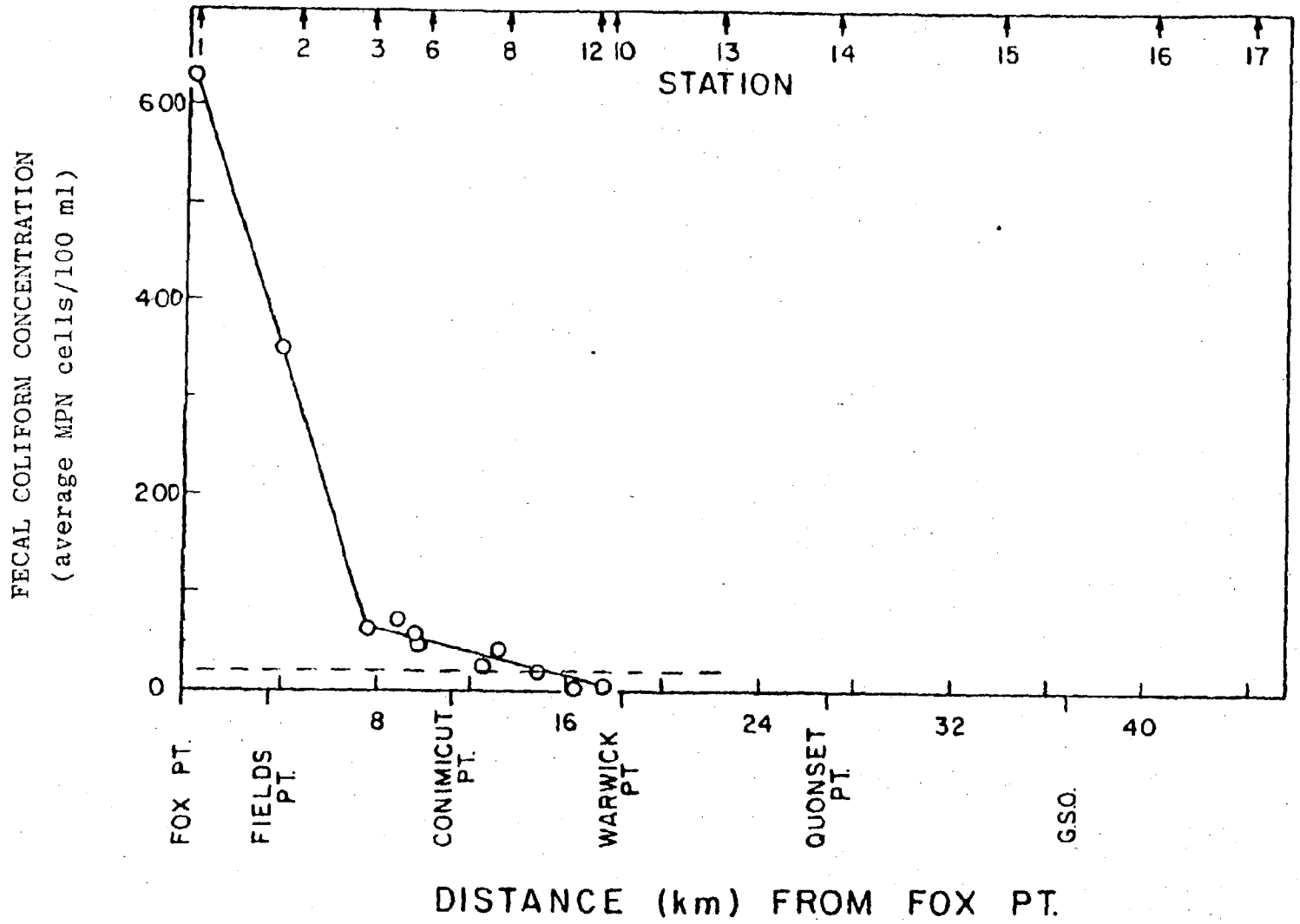


Figure 2. Average fecal coliform concentrations along the Marine Ecosystem Research Laboratory transect, 1979-80. Average of surface and bottom values. Dashed line indicates shellfish limit of 15 MPN/100 ml.

From Oviatt, 1981.[1]

The study of proposed CSO area #2 raises questions about the benefits to water quality which can be achieved by CSO treatment in many areas of Providence. Treatment facility #2 had the largest drainage area and design flow of the nine proposed. The consultants have concluded that "only limited improvements of water quality can be expected as a result of combined sewer overflow abatement within only the CSO #2 area." An examination of the sewer system maps of each of the areas drained by overflows suggests that much of the system is already separated. The downtown area is the most combined and would appear to be the logical place to look for a water quality improvement from CSO treatment. The fact that much of the system is separated does not solve the problems relating to shellfishing. Separate stormwater can be a large source of coliforms and other pollutants, as indicated in Table 2. The most polluted of the combined sewers have higher concentrations than separate stormwater, but stormwater can be far more polluted than the weakest combined sewer overflows.

Let us ignore for the moment the question regarding the importance of CSOs as sources of coliform bacteria. If the proposed CSO treatment facilities were constructed and were effective in reducing coliforms in the Upper Bay, what are the best conditions which could be expected? According to the Combined Sewer Management Report, rainfall in excess of 0.01 inches per hour triggers overflows, resulting in approximately 125 overflow events per year with an average duration of 6-7 hours. Implementation of the nine satellite plants would eliminate 90 percent of untreated overflows, leaving approximately 12 overflow events per year.[2] Since overflows would not be eliminated, it appears that the Upper Bay shellfish area could not be opened unconditionally, although closure days would probably be reduced. Depending on the final designs for CSO treatment, some of the overflows may receive partial treatment and closure regulations could be modified. Assuming that the 12 yearly overflows result in the current 7 or 10 day closure, shellfishing could be prohibited for 84-120 days of 23-33 percent of the year. This estimate ignores the substantial coliform contribution of the rivers and untreated stormwater runoff which could easily increase actual closures. In addition, the productive beds in the northern portion of the Upper Bay are open only in the summer and fall. Last year, access was limited to one day a week to prevent a glut of quahogs on the market. Overflows within 10-day recoveries could result in the loss of two weeks' access to these beds and fishermen worry that a few rainy days could result in a higher proportional closure of these beds.

Other Human Health and Habitat Concerns

If CSOs were treated, and the reduction in coliform levels were sufficient to reduce the number of closure days in the conditional area and extend shellfishing to the quahog beds between Conimicut and Gaspee Points, at least on a conditional basis, what are the other problems in exploiting this resource?

Metals: Concentrations of metals in quahogs from the Upper Bay and Providence River can be compared to alert levels proposed by the Food and Drug Administration (FDA) as indicators for degradation of growing areas due to industrial contamination.[3]

TABLE 2.
Summary of Wastewater Characteristics of Combined Sewage and Separate Stormwater

	Providence, Pawtucket and Central Falls	
	Combined Sewage	Separate Stormwater
5-day - BOD, mg/l	2.5-480	3.5-115
COD, mg/l	32-1360	42.5-410
Suspended solids, mg/l	12-839	15-583
Total coliform, #/100 ml	2×10^5-1.3×10^7	0-5×10^6
Fecal coliform, #/100 ml	230-1.5×10^6	0-1.6×10^4
Lead, mg/l	0.03-3.1	0.03-1.2
Copper, mg/l	0.03-1.6	0.01-0.12
Nickel, mg/l	0.01-2.0	0.01-0.19
Zinc, mg/l	0.04-1.4	0.11-2.2

From the Combined Sewer Management Report, May 19, 1977. Anderson-Nichols & Co., Inc. and Waterman Engineering Co.[2]

Sampling of Upper Bay quahogs indicates that three metals, chromium, copper and zinc are present in concentrations higher than proposed FDA alert levels. While this does not imply a danger to human health, it indicates levels exceed those normally expected in shellfish not affected by industrial pollution (Table 3). Quahogs have also been tested for cadmium and lead, which do not exceed the alert level. No data is available for mercury.

EPA has established guidelines for maximum concentrations of priority pollutants, including metals, in the water which will not interfere with use as a salt water habitat. Separate guidelines have been set for the protection of human health where organisms grown in the water are consumed.[8]

Mercury concentrations in the water exceed EPA Guidelines for human consumption of organisms and for salt water habitat in the industrial area of the Providence River;[9] however, there are no important shellfish beds in this area (Figure 3). Concentrations are also high in the lower Providence River in the vicinity of the rich shellfish beds, but do not exceed EPA standards. Nickel concentrations do not exceed the limit for human consumption, but are greater than the maximum for good habitat, as defined by EPA, along the entire length of the Providence River[10] (Figure 4). In the case of copper, no EPA guidelines have been set for human health, but this metal also exceeds habitat limits throughout the entire Providence River[1, 10, 11, 12] (Figure 5). Lead and cadmium do not exceed EPA guidelines for water concentrations. No data is available for chromium, zinc, silver, or cyanide. According to the available information, metals are typically 10-20 times more concentrated in the Providence River than in RI Sound.

While there are no standards to suggest a critical level for concentrations of metals in the sediments, analyses indicate that metals are 10-100 times more concentrated in the sediments of the Providence River than in the lower Bay. Many metals accumulate in the sediments: up to 75 percent of the copper entering the Upper Bay ends up in the sediments.[12]

Experiments with quahog larvae found a mortality of 10 percent at concentrations of 6 ppb copper and 25 percent mortality at 10 ppb.[13] These concentrations are equivalent to average levels in the lower Providence River and off Field's Point, respectively (Figure 5). However, the experiments were conducted with inorganic copper only, while the mixture of copper forms found in the river may be less toxic. Chromium affects clam and mussel metabolism [14] and zinc retards bivalve development and sperm motility.[15] Silver was identified as one of the more toxic metals to quahog larvae and high concentrations have been found in Long Island Sound.[16] Some information on silver concentrations in Narragansett Bay would be useful.

Actual toxicity will vary depending on conditions in the Bay. Some of these effects may tend to balance each other out. For instance, metal concentrations are highest in the winter,[1] but some metals are less toxic at low temperatures.[17] An important consideration in planning improvements is the effect of combinations of metals. While most experiments are conducted with a single metal, the presence of another metal can increase the toxicity. For example, zinc makes copper more toxic to bivalves.[18] This synergistic effect is likely to occur in the complex metal mixtures found in the Providence River, implying that metal standards should be set with a margin for safety.

TABLE 3.
Metals Exceeding Alert Levels in Upper Narragansett Bay Quahogs

Metal	Proposed FDA "Alert Level" for Quahogs[3]		Concentrations in Upper Bay Quahogs		Reference
	ppm wet weight	ppm dry weight	ppm wet weight	ppm dry weight	
Chromium	1.0		0.5 - 1.2*		USACE, 1976[4]
			0 - 1.6*		DEM
		10		10.5 - 25*	Phelps, 1975[5]
Copper	10		8 - 13*		USACE, 1976
			1 - 14*		DEM
		100		80	Jernigan et al., 1970[6]
Zinc	65		7 - 66*		DEM
		650		240	Eisler et al., 1978[7]

*Exceeds alert level

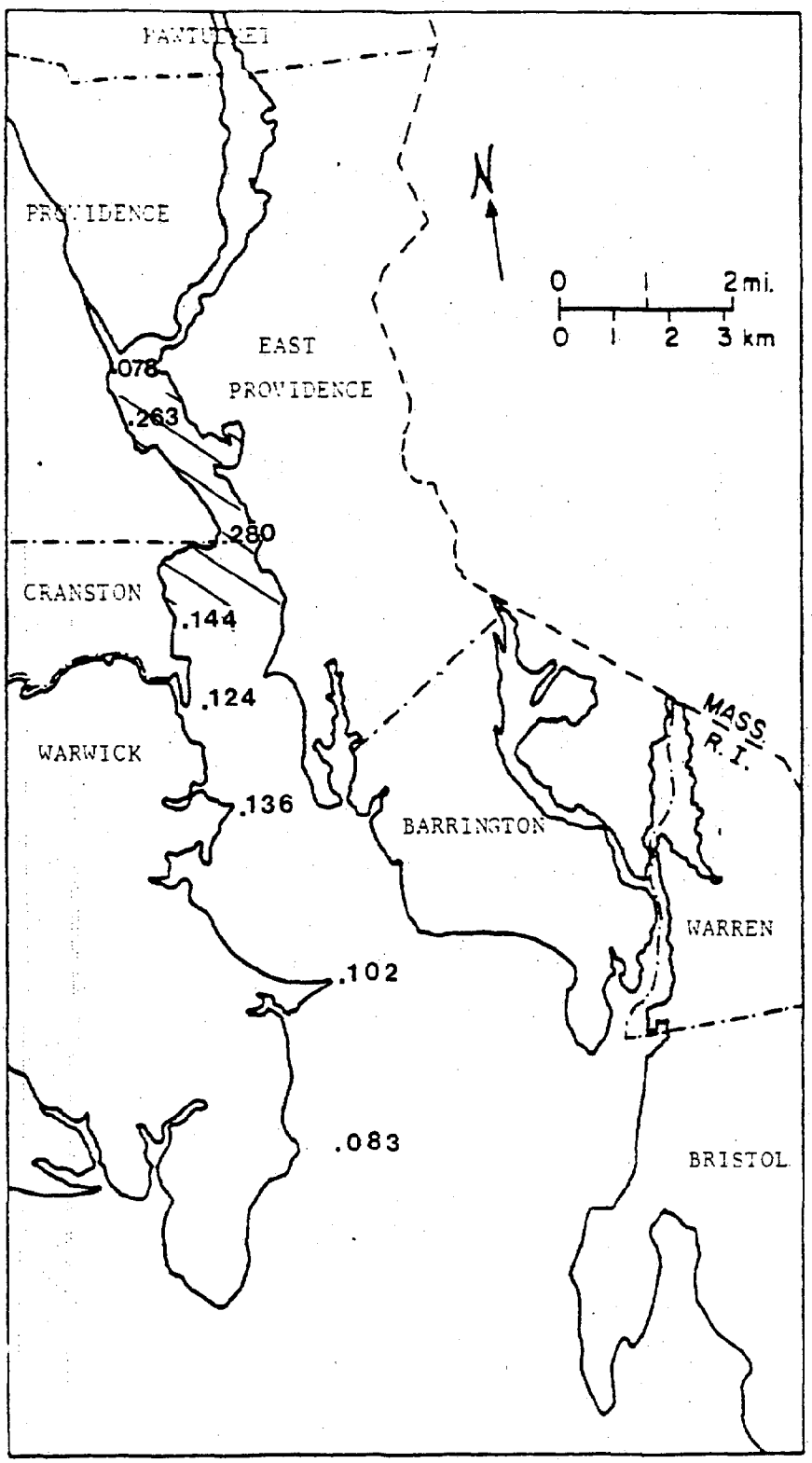


FIGURE 3.
Mercury Concentrations in Upper Bay Water (ppb) (Mukherji, 1979)[9]
EPA Guideline for Salt Water Habitat: .250 ppb
EPA Guideline for Human Consumption: .146 ppb

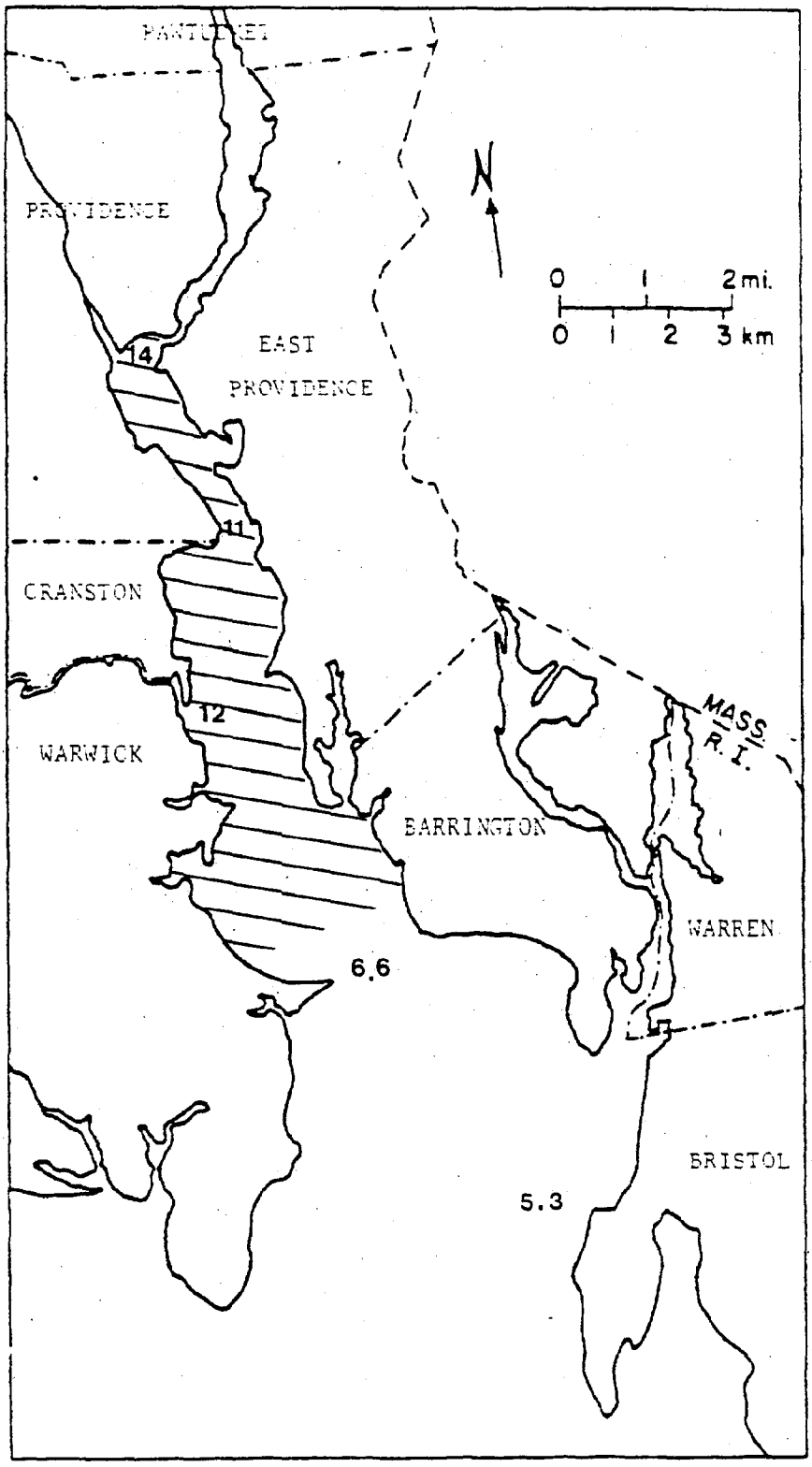


FIGURE 4.
Nickel Concentrations in Upper Bay Water (ppb) (Bender, 1977)[10]
EPA Guideline for Salt Water Habitat: 7.4 ppb
EPA Guideline for Human Consumption: 100 ppb

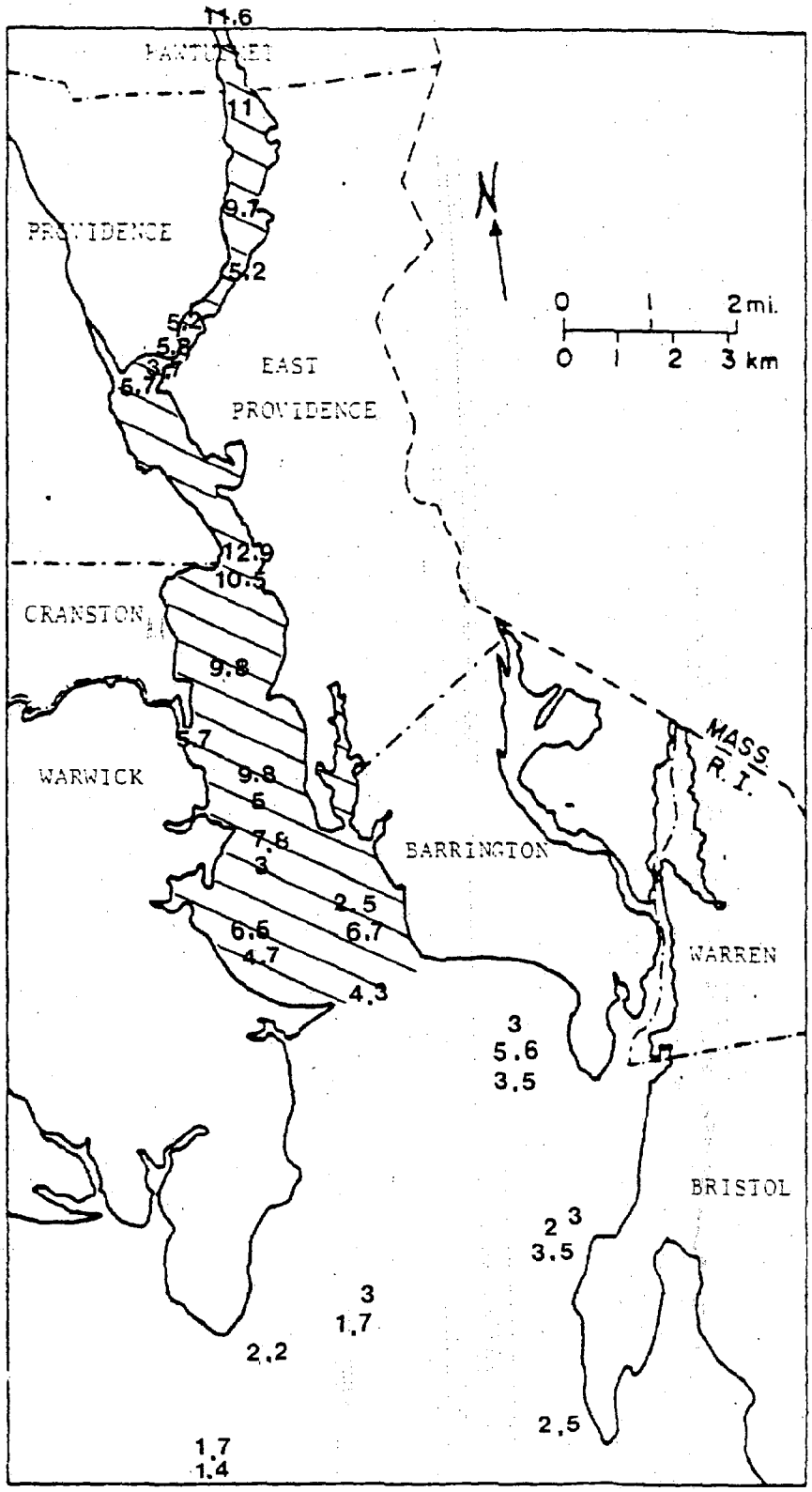


FIGURE 5.
Copper Concentrations in Upper Bay Water (ppb)[1, 10, 11, 12]
EPA Guideline for Salt Water Habitat: 4.0 ppb

It is evident that concentrations of several metals are elevated in the area of potential shellfishing in the Providence River. None of the concentrations exceed current EPA health standards for consumption of shellfish, but several are high enough to degrade the habitat and reduce quahog growth and survival. More specific information on quahog requirements will be gathered during the coming year by Dr. Richard Crawford at the Coastal Resources Center, but at present it appears that metal concentrations would interfere with the health of the shellfish resource north of Conimicut Point.

Different sources are responsible for different metals. The Providence sewer system receives 1735 industrial effluents which funnel through the Fields Point plant,[19] the major source for copper, nickel, zinc and chromium. Lead enters the Providence River primarily from runoff. The Blackstone River is the major source of cadmium and also contributes some copper and lead. While nonpoint sources for metals such as runoff would be hard to control, the Field's Point treatment plant is an important source of most of those metals which exceed alert levels or EPA Guidelines: copper, nickel, chromium and zinc. Sources of mercury need more investigation. A comparison of metal concentrations in the waste flowing to the treatment plant during the partial vacation shut down of industry for the first two weeks of July, 1980, and during subsequent industry operations, supports the conclusion that a high proportion of most metals are due to industrial effluents (Table 4). Since the shut down was only partial, the actual contribution by industry is probably even higher. Thus it would appear that an aggressive pretreatment program requiring a reduction of metals before discharge of industrial effluent to the sewer system could be very effective in reducing metals entering Narragansett Bay. A pretreatment program for the Providence sewer system is being developed by Charles Krasnoff & Associates.[19] As currently proposed, the pretreatment program would limit only copper and nickel, reducing the concentration which industries could add to the sewer system to about half their current levels. The effect of such reductions on the levels present in the Bay will depend on industrial and domestic water use, removal efficiencies at the Field's Point Plant, industry activity, and processes within the Bay, such as water circulation and exchange of metals between the water and sediments. Experiments at MERL have given optimistic indications of the effects of reducing pollutant loadings. New, clean sediment encased the metals in the old bottom material and concentrations improved in the water column.

Petroleum hydrocarbons: Experiments conducted at URI's MERL indicate that concentrations of #2 fuel oil in the sediment in excess of 500 ppm have a chronic deleterious effect on the organisms.[20] This number cannot be applied directly to Narragansett Bay since #2 fuel oil is one of the most toxic forms, while a mixture of hydrocarbons are present in Narragansett Bay sediments that may be less toxic. However, sediment concentrations exceed this chronic level in the Upper Bay and increase to 10 times in the Providence River (Figure 6). Hydrocarbons have been shown to decrease growth rates of very young quahogs.[25] Used crankcase oil, which accounts for about 10 percent of the total reaching the Upper Bay, was the most toxic tested. Quahogs incorporate hydrocarbons into their tissues and shellfish taken from the Upper Bay are visably darker than those from areas with lower hydrocarbons. The effect on people is unknown.

TABLE 4.
Industrial Metal Contributions to Field's Point Wastewater Flows

Metal	% of load due to industries shut down, July 1980
Cadmium	69
Copper	61
Chromium	68
Lead	7
Nickel	67
Silver	52
Zinc	73
Cyanide	80
Mercury	21

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from Table 17, Industrial Wastewater Pretreatment Program: Pretreatment Limitations, Charles J. Krasnoff & Associates, Inc., January 28, 1982.[19]

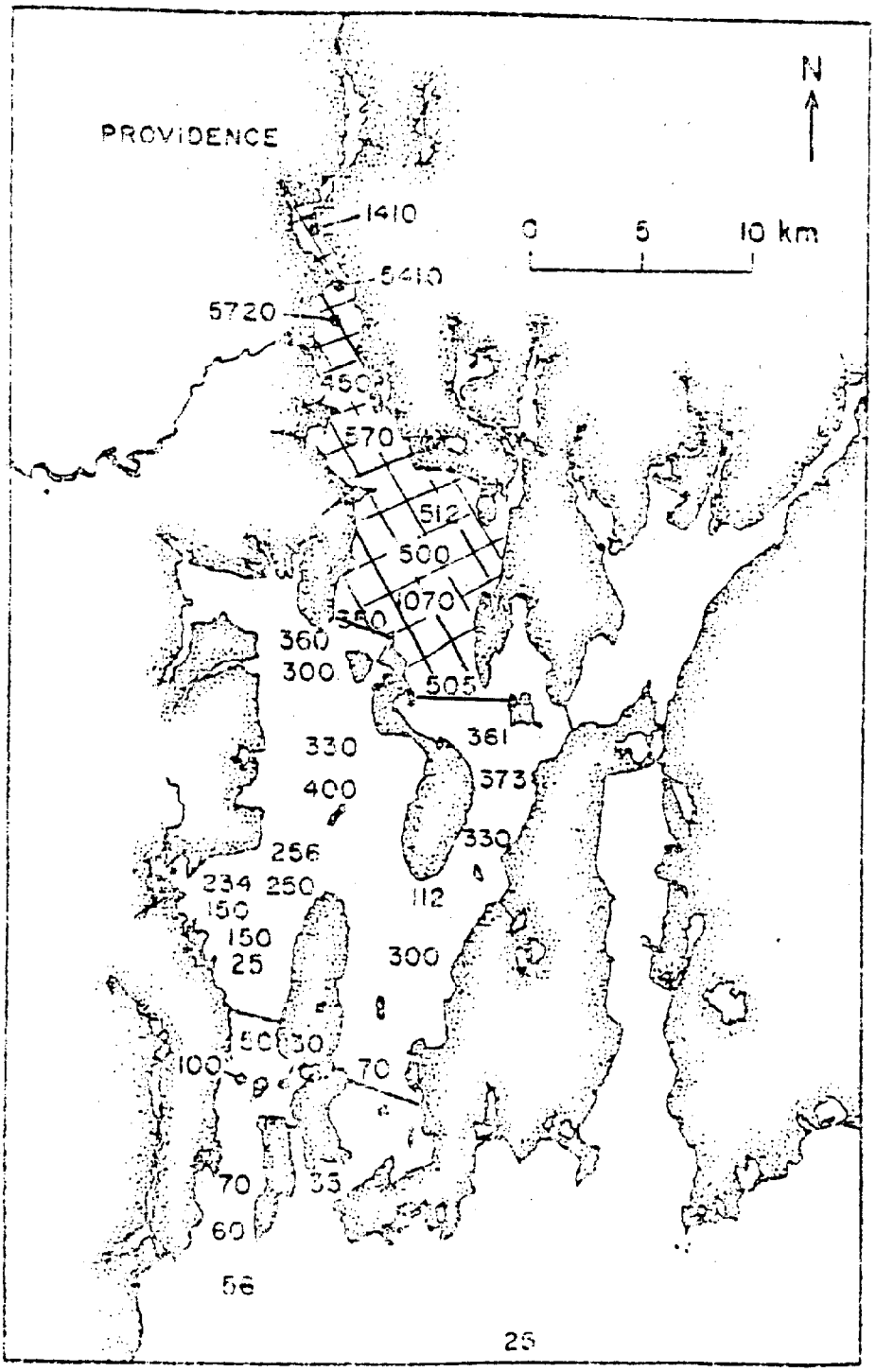


Figure 6 Surface sediment concentrations of petroleum hydrocarbons and sampling station locations in Narragansett Bay (0-10cm; ppm dry wt.).

From references 21 , 22 , 23 , 24

Dr. Eva Hoffman has investigated the sources of petroleum hydrocarbons in the Upper Bay and its watershed (Figure 7).[26] Sewage treatment plants and CSO dry weather flows contribute an estimated 60 percent of the total, with 50 percent entering from the Providence system. Much of this portion could be removed by industrial pretreatment. However, at present, the environmental effects of hydrocarbons have not been considered in setting petroleum limits for the industrial pretreatment program. Crankcase oil is also known to be an important and particularly toxic component of hydrocarbons in the sewer system. A waste oil recycling program was instituted in 1980 in an effort to reduce improper disposal. Unfortunately, data necessary to evalute the success of the publicity program to encourage recycling is not available. However, rough calculations indicate that service stations alone generated more used oil than the amount recycled last year. In addition, 35 percent of Rhode Islanders change their own oil. An aggressive program could reduce the amount discarded down drains and dumped on the ground.

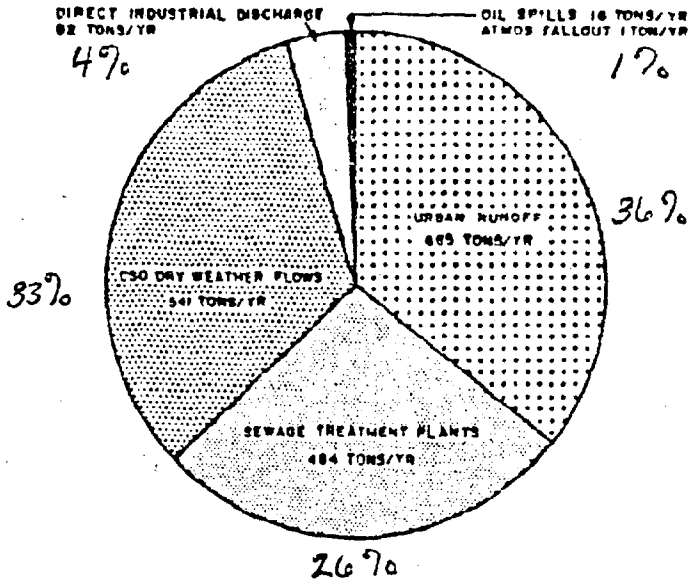
One of the problems in projecting water quality improvements if oil inputs to the Bay were reduced is the persistence of hydrocarbons in the sediments. In the MERL experiments, one shot class of oil was added to 22 tons of water. After one year the sediment had not cleansed itself, and projections indicated that the process would take two years. Experience with oil spills suggests that recovery from these large amounts of oil generally occurs within 10 years.

Oxygen: A sufficient level of oxygen dissolved in the water is perhaps the major requirement for a good habitat. Four milligrams per liter (mg/l) is a general level considered necessary, although quahogs can survive lower levels for a few days by becoming completely inactive. However, the more stressed the population is by other pollutants such as metals and hydrocarbons, the less likely the quahogs are to survive even short periods of oxygen stress. Mass mortalities have been observed in the Providence River and oxygen concentrations are very low every summer often reaching zero in the upper areas of the river (Figure 8).

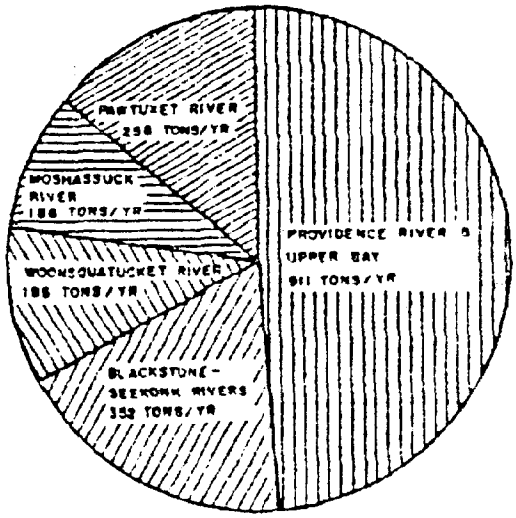
Several factors can cause low oxygen concentrations. Cold water can contain 50 percent more dissolved oxygen than warm water, which is one reason why problems are more acute in the summer. Undecomposed organic matter such as that found in sewage treatment plant effluent is mostly in the form of ammonia, which uses oxygen in a chemical conversion to nitrate. Nutrients such as nitrogen, phosphorus and silica entering from the rivers, CSOs, runoff and effluents stimulate the growth of microscopic plants called phytoplankton. These plants produce oxygen as they grow, but their decay consumes large amounts of oxygen. Respiration of organisms in the sediment also removes oxygen from the water. The oxygen required to decompose organic matter in treatment plant effluent is measured over 5 days as Biological Oxygen Demand (BOD). Sewage treatment plant effluent is often regarded as the major cause of oxygen depletion in pollution urban waters. However, preliminary estimates for the Providence River suggest that nutrients may be an even more important cause of the oxygen problem (Table 5). While treatment plant BOD may account for less than 20 percent of the total demand, the indirect effects of nutrients leading to phytoplankton decay and the direct

Figure 7

OIL POLLUTION IN THE
UPPER NARRAGANSETT BAY WATERSHED



POINT OF ENTRY OF OIL POLLUTION
UPPER NARRAGANSETT BAY WATERSHED



from E.J. Hoffman et al, 1982[26]

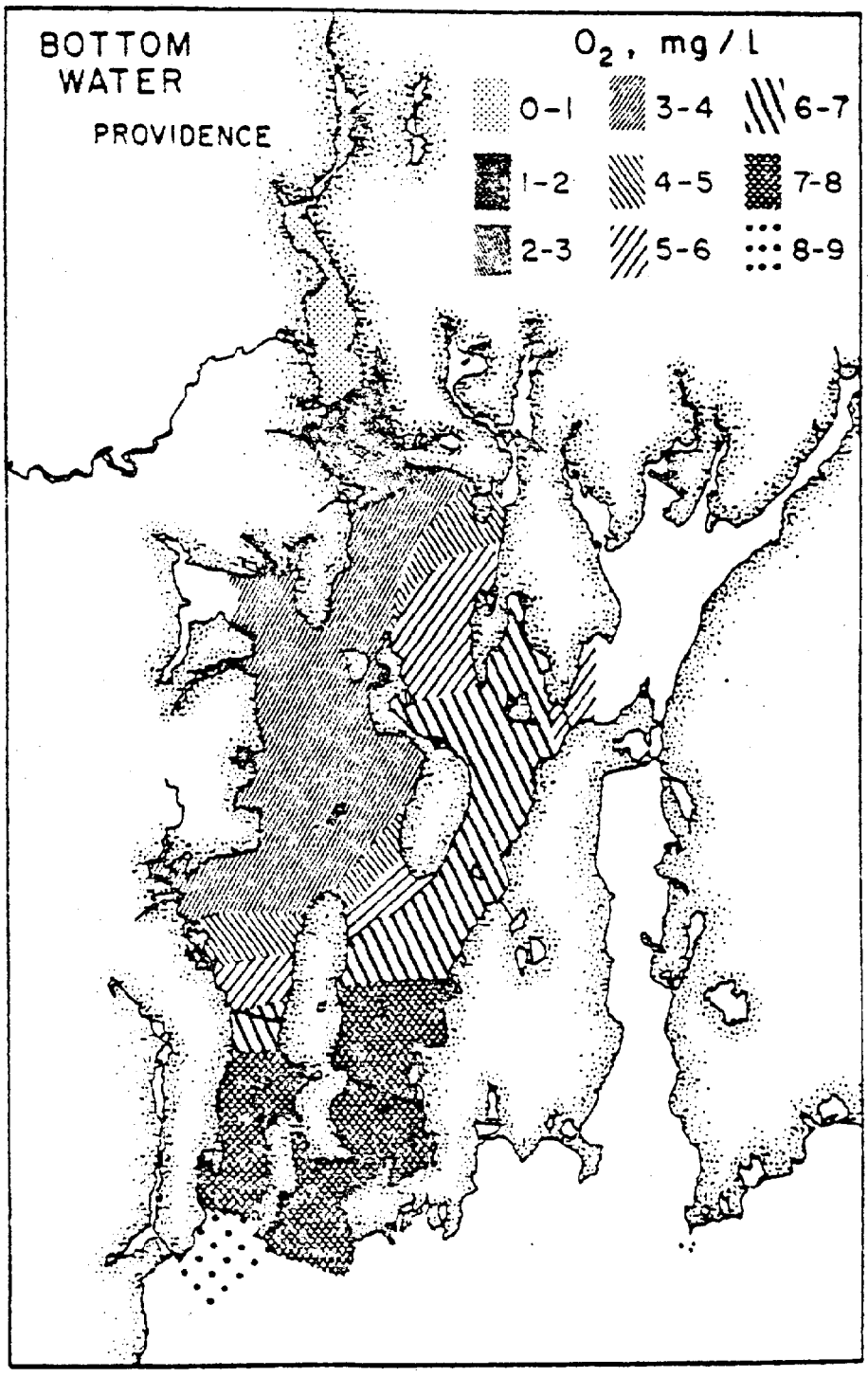


Figure 8 Approximate distribution of dissolved oxygen in the near bottom waters of Narragansett Bay on July 26-27, 1972. Data from the University of Rhode Island "Bay Watch" program.

TABLE 5.
Preliminary Estimates of Oxygen Requirements in the Providence River.[27]

Source	Metric Tons Oxygen Per Day	Percent
3 sewage treatment plants		
carbon (5 day BOD) 1977	22	17
ammonia	12.5	10
phytoplankton decay	55	44
sediment removal	36	29

effects of ammonia oxidation may require more than 50 percent of the oxygen demand.[27] Dr. Scott Nixon of URI will be studying this problem in the Providence River starting this summer.

Effective secondary treatment at the Field's Point plant will reduce the BOD from this source, which accounted for 59 percent of the total from sewage treatment plants in 1977.[28] If nutrients are confirmed to be a major reason for low oxygen levels in the Providence River, tertiary treatment to reduce nitrogen in sewage effluents is an effective, but expensive possibility for reducing the loadings. This would, however, represent only a partial solution. Recent estimates of nutrient sources by both Dr. Nixon and MERL have concluded that the Blackstone and Pawtuxet Rivers contribute more nitrogen, phosphorus and silica than the Field's Point, Bucklin Point and Riverside treatment plants combined. Nutrients and organic matter enter these rivers from point sources such as CSOs and treatment plants, but they also drain large watersheds with non-point sources such as runoff.

Oxygen has been one of the pollution problems most successfully tackled in other locations. In the estuary of the Thames River in England, for example, data on oxygen conditions in the estuary were combined with a computer program to predict the benefits of various levels of sewage treatment. As a result of stringent treatment of BOD at a few of the plants (important because of large flows or their location in the estuary) and management to maintain sufficient freshwater flow, conditions in the Thames have improved to the point where fish, completely absent during the 1950s, have returned to the river.[29] Similar predictions should be possible for Upper Narragansett Bay using Dr. Nixon's data and the circulation models developed by Dr. Malcolm Spaulding of URI.

Volatile organic compounds: Recent URI surveys have identified the major volatile organic compounds in Narragansett Bay. Field's Point is the principle source of chlorinated hydrocarbons and the Pawtuxet River is a major source of aromatic compounds (Table 6). Concentrations are highest during the winter. None of the levels exceeded EPA habitat criteria. EPA calculates the level of carcinogenic compounds which may result in incremental cancer risk for a lifetime exposure at various risk levels, but does not make any judgment on an acceptable risk.[8] Maximum concentrations of tetrachloroethylene in the Providence River and at Conimicut Point exceed the 10^{-7} risk factor for consumption of shellfish. The Field's Point Plant is the major source of this compound. A major problem in regulating volatile organic compounds based on their effects on shellfish would be the lack of knowledge regarding the extent to which organic compounds degrade the habitat for shellfish.

Chlorine: Disinfection of effluents with chlorine provides a solution to the problem of high coliforms which interefere with shellfishing, but also has the potential to create new habitat problems. Rhode Island plants are required to maintain total residual chlorine levels at 2 mg/l year round. It has been assumed that effluents to the Providence River are probably dispersed rapidy to levels low enough to avoid effects on marine shellfish, but this assumption should be evaluated. The rivers may be even more sensitive to chlorinated effluents. Concentrations have been calculated for low

TABLE 6.
Principle Volatile Organic Compounds in Narragansett Bay

Major Sources	Compounds
Field's Point Treatment Plant	trichloroethylene
	tetrachloroethylene
	1,1 trichloroethane
	ethyl benzene
Pawtuxet River	orthochlorotoluene
	chlorobenzene
	toluene
	ethylbenzene

from M. McGregor, personal communication and Oviatt, 1981.[1]

flow river conditions (Table 7) which exceed EPA's recommended levels for maintaining habitat. If CSO treatment facilities are built, they would contribute additional chlorine to both freshwater and marine systems. Dechlorination is an additional treatment which can be applied to effluents to remove chlorine following disinfection. Without such a procedure it may be necessary to make a trade off between the potential for fish in the river and access to shellfish.

Fishery Management Questions

Fishery management objectives must be considered as well as pollution problems in setting goals for shellfishing activity in the Upper Bay. One argument against opening more territory or reducing closure time in the conditional area is that the populations of quahogs in the areas closed due to pollution may be an important source of seed currently maintaining the beds in the rest of the bay. A study of quahog production in Green South Bay, Long Island, suggests that the areas closed due to high coliform concentrations are acting as a brood stock for the areas open to harvesting. Indirect evidence suggests that a similar situation may exist in Narragansett Bay. Quahog landings were high in Rhode Island in the 1950s and declined throughout the 1960s. Two to three years after closures began in the area south of Conimicut Point (1969) young, high priced little neck qoahogs increased throughout the Bay and landings began to rise. Since it takes two to three years for a quahog to grow to harvestable size, the two events may be linked. If quahogs in the closed area are serving as brood stock for the rest of the bay, expanding the harvesting opportunities may decrease the overall availability of the resource.

One management technique in practice in RI is transplanting quahogs. Fishermen are paid 3¢ per pound to dig and move quahogs under state supervision from the closed area to designated areas in the rest of the bay, which are then opened the following winter. Depuration is a technique currently prohibited, where private companies harvest quahogs from closed areas and treat them in tanks to eliminate bacteria before sale. Shellfishermen vigorously oppose such an option fearing this practice would give a few large operations control of the market. From a health point of view, quahogs can cleanse themselves of bacteria in ten days at 50°F, but half the hydrocarbon content persists for three months.[32] After 30 days in clean water, quahogs from the Providence River still had significantly higher levels of cadmium, copper, nickel, lead, and titanium than quahogs initially from clean sites. Differences in body content of silver and aluminum disappeared with 30 days of depuration.[33]

Summary

Water quality necessary for shellfishing must be examined in terms of both the requirements for harvesting and the requirements for a healthy habitat and the long term maintenance of the resource. The CSOs and Field's Point treatment plant of the Providence sewage system are a major source of many pollutants, but by no means the sole source. The upgrading of the Providence system should reduce BOD and coliforms, but the effect of the reduction will depend on the relative importance of other source, such as rivers. Based on present plans for facility improvement and construction, it would appear that reducing the number of closure days is a reasonable goal if plans proceed

TABLE 7.
Calculated Chlorine Concentrations in the Pawtuxet, Woonasquatucket and Blackstone Rivers

	Treatment Plants Discharging	Calculated Total Residual Chlorine (ppb)
Pawtuxet	West Warwick	520
	Warwick	
	Cranston	
Woonasquatucket	Smithfield	510
Blackstone	Woonsocket	250

from "Draft EIS for Cranston Wastewater Collection and Treatment Facilities", C.E. Maguire, October 18, 1976. [30]

EPA recommended maximum levels are 2 ppb for salmonid fish and 10 ppb for other freshwater and marine organisms. [31]

for treating CSO overflows as well as treatment plant effluents. Complete unconditional opening will probably remain impossible due to a small but continual number of overflows per year. Opening the beds north of Conimicut Point will require addressing the metal problem. Effects of hydrocarbons and organics on the health of the resource need further evaluation, but these pollutants also appear to constitute problems north of Conimicut Point. Increasing oxygen levels to improve habitat may require long-term strategies to reduce nutrient loadings or may be as simple as completing the upgrading of the Field's Point Plant. Effective depuration of metals and hydrocarbons should be demonstrated before a more extensive program of transplanting is considered. While more information should be gathered to determine the importance of quahogs in the closed areas as a brood stock, present implications suggest that the shellfish resource levels throughout the bay may benefit from closures in the Upper Bay. Even if areas of shellfish beds remain closed to harvest, for either water quality or fishery management reasons, reducing pollutants to improve habitat conditions could benefit quahog production on a baywide basis.

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2. HOW IS WATER QUALITY RELATED TO FINFISHING OPPORTUNITIES IN THE UPPER BAY, PROVIDENCE RIVER AND SEEKONK RIVER?

The Finfish Resource

A rich variety of fish are present in the Upper Bay. The Rhode Island Department of Environmental Management has sampled fish every month at four locations in the Bay since 1969, capturing 46 different species. The four most common species were winter flounder, scup, butterfish and sand flounder.[1] There are no surveys north of Popasquash Point, but collections of fish from screens at the New England Power stations north of the hurricane barrier give us some information on the types of fish in the Providence River. Forty-one different species have been found from 1975 to 1978 (Table 1).[2] The most abundant species is the Atlantic menhaden, a migrant fish present in the Bay during the summer. Fish are reported by recreational fishermen as present in the upper reaches of the Seekonk River (Table 2).[3]

The winter flounder is the most abundant bottom-living fish in Narragansett Bay.[1,4,5] Unfortunately, catch data on this and other species are reported by National Marine Fisheries Service for landings at Rhode Island ports, irrespective of where the fish were caught. In 1978, commercial landings of winter flounder in Rhode Island totaled 2,400 metric tons and were valued at more than 2 million dollars.[6] Thanks to a detailed survey of sportfish in Rhode Island waters, we have a good indication of this activity. In 1978, sportfishermen made 1,285,000 trips in Rhode Island waters, spending $7,133,000 to catch 5,843,000 fish of which 1/5 (760 metric tons) were winter flounder.[7] Thirty percent of the winter flounder caught by recreational fishermen in Narragansett Bay were taken from the Upper Bay.

Adult winter flounder enter Narragansett Bay during the fall. In winter they move into shallow coves to spawn, after which they return to the Bay proper, moving offshore by June. Their eggs are laid on the bottom and may remain there for more than three weeks. The larvae are planktonic and spend approximately four weeks in the water column before taking up the bottom dwelling life of flatfishes. One or two years later, they join the migration out of the Bay during the summer months.

The Upper Bay and the Providence River are recognized as important winter flounder spawning and nursery grounds. During a recent EPA study, sexually mature winter flounder were collected from the Providence River. Tagged fish from this area were later captured by the commercial fishing fleet in the southern portion of the bay. EPA divers have routinely observed juvenile winter flounder at Sabin Point, Providence River.[8] Larval collections suggest the upper bay and Providence River are a significant source of winter flounder larvae in Narragansett Bay.[9]

The Upper Bay has been closed to all bottom trawling for nearly 30 years, for reasons unrelated to water quality. When the commercial fleet was allowed to drag their nets in the upper Bay, numerous small flounder were killed and there was concern by fisheries managers that this mortality was potentially serious and extremely wasteful.[10] For the past few years there has been increasing pressure from some local fishermen to relax the closure in the

TABLE 1.
FINFISH IMPINGED ON SCREENS AT MANCHESTER AND SOUTH STREET STATIONS 1978-1978.

Major species--accounting for more than 90 percent of the fish caught

- Atlantic menhaden
- Atlantic silverside
- Silverhake
- Mummichog
- Winter flounder
- Alewife
- Weakfish
- Striped killifish

Minor species

- American eel
- Atlantic herring
- Atlantic mackerel
- Atlantic moonfish
- Atlantic tomcod
- Bay anchovy
- Black sea bass
- Blueback herring
- Bluefish
- Bluegill
- Blue runner
- Butterfish
- Chain pickerel
- Crevalli jack
- Cunner
- Fourspot flounder
- Grubby
- Largemouth bass
- Little skate
- Lump fish
- Northern pipefish
- Northern searobin
- Rainbow smelt
- Red hake
- Smallmouth flounder
- Spotted hake
- Striped mullet
- Striped searobin
- Tautog
- Three spine stickleback
- White hake
- White perch
- Windowpane

Source: Marine Research, Inc., 1978.

TABLE 2.
FISH CAUGHT IN THE SEEKONK RIVER

Bluefish

Carp

Large mouth bass

White perch

Yellow perch

Source: W. Parent, Parent's Marina

upper Bay, particularly during the summer and fall months. The R.I. Inshore Draggermen's Association wants access to the stock of scup which move up into the Upper Bay during this time. This is also the period when the Upper Bay is an important winter flounder nursery area. The R.I. Marine Fisheries Council has this proposal under consideration and is entertaining public hearings on this matter.

There are numerous other species of fish in the Upper Bay. Among these are striped bass, bluefish, weakfish, scup, menhaden, shad, American eel, tomcod, and others. Some of these species support commercial and sportfisheries. Almost all of the striped bass and nearly 40 percent of the bluefish caught in the Bay by recreational fishermen come from the Upper Bay.[7] Striped bass, bluefish and weakfish are predators which feed on silversides, mummichogs and menhaden. These smaller fish are attracted to the Upper Bay to feed on abundant plankton blooms. Menhaden spawn in Narragansett Bay in the summer and travel south along the Atlantic coast as far as Florida in the winter. They support a large commercial fishery along the east coast, with the catch in Narragansett Bay ranging from 15 to 23 million pounds in recent years.[11]

Water Quality Concerns

Oxygen: Sufficient oxygen is a major requirement for fish species. Fish will generally avoid areas of low oxygen, but the more stationary species, such as flounder may be killed. Oxygen depletion in the bottom waters of the Providence River has been observed during the summer [12,13] and is believed to have been responsible for mass mortalities of quahogs and flounder which EPA and DEM have observed in the Providence River.[10,14] Oxygen levels typically become more depleted near the bottom than at the water surface. Because of this, pelagic fish may be able to migrate through the area in the surface water when low oxygen levels may prevent bottom dwelling fish from surviving and reproducing. This is believed to be the explanation for the presence of fish at the power plants even when oxygen levels are low in the Providence River during the summer.

Management programs in many locations have been successful in improving oxygen conditions. Examples are the Potomac River and Thames River in England, where models were developed of the oxygen conditions which were used to predict the effect of proposed improvements and to allocate loadings. Models of circulation, such as those developed by Malcolm Spaulding at URI, could be combined with oxygen information, such as that which will be collected this summer by Dr. Scott Nixon, to provide a similar analysis in Narragansett Bay. Once the relative importance of sewage treatment plants, rivers and CSOs as sources of oxygen depleting organic matter and nutrients are determined and the mechanisms which result in low oxygen are explored, then these models can be used to determine how much of a reduction in organic loadings or nutrients will result in what levels of oxygen. With this information logical strategies for improvement can be developed.

Hydrocarbons: Winter flounder eggs stripped from fish captured in the Providence River have elevated levels of hydrocarbons, according to the preliminary results of an EPA study.[8] Runoff, sewage treatment plants and combined sewer outfalls are the major sources of approximately 1800 tons of

petroleum hydrocarbons entering the Bay each year.[15] Recent estimates suggest that approximately 200 metric tons or 10 percent is used crankcase oil.[16] Crankcase oil is known to be a potent fish mutagen,[17] but it is not known whether significant mutation rates are occurring in Providence River populations. Concentrations of petroleum hydrocarbons in the sediment of the Providence River and Upper Bay are 200 times higher than the levels in Rhode Island Sound. Recent work at URI's Marine Ecosystem Research Laboratory has suggested that hydrocarbon concentrations in the sediment from Prudence Island north may have long term chronic effects on organisms. (See description in shellfish section). Experiments have shown that winter flounder exposed to sediment contaminated with crude oil (2300 to 4500 ppm have elevated mortalities and decreased feeding rates.[18] Hydrocarbon concentrations exceed these levels in sediments near Fields Point (5400 to 5700 ppm),[19, 20] but concentrations cannot be compared directly since the crude oil used in the experiments may be more toxic than the hydrocarbons present in the Bay.

One of the difficulties in constructing a framework for planning hydrocarbon reductions is the lack of federal guidelines or criteria on which standards can be based. There are guidelines for some of the specific hydrocarbon compounds in water, but there are none for the sediments, which is where most of the hydrocarbons collect. Winter flounder may have a higher exposure to hydrocarbons than fish which remain in the water column because they ingest some sediment with their food as they forage along the bottom. Industrial pretreatment and an aggressive waste oil recycling program have been identified as the most effective means of controlling hydrocarbon loadings.

Metals: Three metals exceed EPA guidelines for salt water habitat. Mercury exceeds this guideline in the Upper Providence River and also exceeds the guideline for human consumption. Copper and nickel exceed their guidelines north of Conimicut Point (see shellfish chapter for maps). This data indicates a degraded habitat north of Conimicut Point. There are no FDA limits for metals in fish except for mercury (1 ppm in the edible portion). We are unaware of any studies on mercury content of fish from the Providence River. Eggs from winter flounder captured in the Providence River do have elevated metal contents.[8]

Many of the metals of concern enter the Upper Bay in the effluent from the Field's Point Treatment Plant. Sewage treatment plants are not designed to to remove metals, although some settle out with particulates. The most effective treatment can be provided at the industrial source, before metals are diluted in the sewer system. For this reason, a strong industrial pretreatment program would be the most effective means to reduce metal concentrations and improve fish habitat.

Sublethal effects of metals are less well known for fish than for shellfish. It is known that a mixture of metals, such as that found in Upper Narragansett Bay is more toxic than the individual metals. For example, copper and zinc mixtures are more toxic than the sum of their individual toxicities and both copper and zinc increase cadmium toxicity.[21] This implies that in the Providence River, metal levels should be reduced below the individual EPA guidelines, which were derived for single metals. This might compensate for the mixture of metals present in local waters.

PCBs: PCBs (polychlorinated biphenyls) are another contaminant found to be elevated in Providence River winter flounder eggs. PCBs in surface sediment near the Field's Point sewage treatment plant outfall and one mile downstream are approximately 1,000 ppb [22] (as compared to levels less than 10 ppb in Rhode Island Sound)[23] Elevated PCBs in fish eggs have been associated with reduced hatching and survival in salmonid fish [24] and reproduction of local species may be similarly affected. The Providence area appears to be the major source of PCBs to Narragansett Bay, since sediment concentrations are higher in the Providence River. Levels in sewage treatment plant sludge were 10 times higher at Field's Point than any other Rhode Island plant.[25] PCBs are not regarded as a major problem in Narragansett Bay, compared to such areas as the Hudson River where levels in fish constitute a danger to people consuming them.

Management Issues

The minimum water quality classification is SC, which is described as suitable for shellfish and wildlife habitat. Unlike shellfish, access to finfish has been restricted for fishery management rather than water quality reasons. In the absence of evidence that pollutant levels in the fish are high enough to affect people consuming them, the major water quality management question in terms of fisheries is one of providing a healthy habitat for fish.

To establish a framework for such water quality management, the first question which must be addressed is "What are the qualities of a good habitat and where are areas where such conditions exist located in Narragansett Bay?" Habitat can be differentiated into habitat for spawning, nursery grounds, feeding, and migration. We do not now know the locations of important habitat areas for the common species in Narragansett Bay. Dr. Richard Crawford of the Coastal Resources Center will be initiating a project this year that should locate flounder spawning sites in the Providence River.

A second question is "In what areas is the habitat degraded?" The EPA guidelines indicate that habitat is degraded north of Conimicut Point. By comparing growth rates of larvae from the Providence River and Upper Bay with flounder from Charlestown Pond, Dr. Crawford hopes to shed some light on the impact of pollution in the Upper Bay on flounder larvae.

This study will greatly refine our knowledge of Upper Bay fishery habitat. With our current knowledge, we have a basis for saying that metals are degrading the habitat north of Conimicut Point and that summer oxygen levels must be improved if the survival of bottom species is to be improved. While all areas of the Bay are currently designated for habitat through the minimum SC category, the water classification system is being revised by the state. If areas are designated as specific types of fishery habitat in a special area plan, water quality criteria can be developed for the purpose of protecting those specific habitat requirements.

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3. IS WATER QUALITY INTERFERING WITH SWIMMING IN THE UPPER BAY OR THE PROVIDENCE RIVER?

Upper Bay Beaches

"Going to the beach" is one way many Rhode Islanders take advantage of life in the Ocean State. There are more than 2 miles of beaches around the Upper Bay which are especially important because of their close proximity to the state's population centers. State, local and private beaches are shown in Figure 1, along with areas identified as sandy beaches and spits. There are no large stretches of sandy beach north of Sabin Point. The Seekonk River has a mud bottom and generally a steeply sloping shoreline. It is shallow and at low tide mud flats extend some distance out from the shore. The upper Providence River is largely bulkheaded and the proximity of industrial facilities makes it an unlikely choice for swimming.

Public Health Concerns

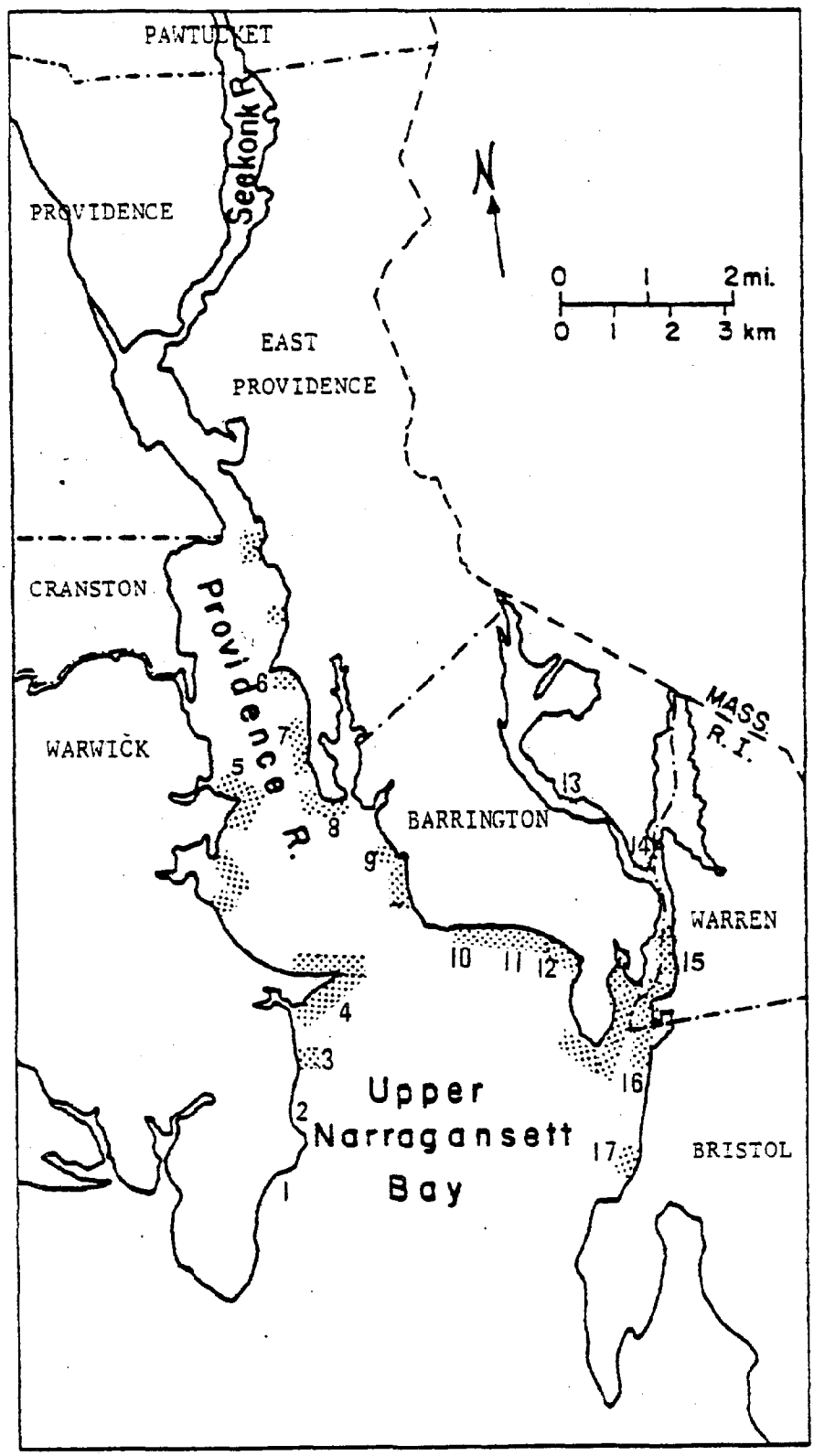
According to the current Rhode Island water quality classification, SA and SB category waters are acceptable for swimming and recreational use. SB standards include a maximum concentration for total coliform bacteria of 700 MPN/100 ml (most probable number per 100 milliliters) and a fecal coliform limit of 50 MPN/100 ml. Coliform bacteria live in the intestines of warm blooded animals and are used to indicate the presence of fecal material. They are not themselves harmful, but have been widely used as a regulatory tool because of their ease of measurement.

The Rhode Island Department of Environmental Management (DEM) routinely monitors coliform levels at Rhode Island beaches. They do not have the legal authority to order a beach closed, but can post signs recommending against swimming. This was done in 1979, the year that the entire Upper Bay was closed to shellfishing on an emergency basis due to the poor condition of the Field's Point sewage treatment plant.

The use of total and fecal coliform bacteria as indicators was developed as a regulatory tool for shellfish closures. Recent studies have shown that they may be as useful for determining water quality for swimming. In an EPA study of swimmers at Coney Island and Rockaway Beaches, the incidence of gastrointestinal symptoms was not related to total or fecal coliform concentrations. It was found that fecal streptococci (also called enterococci) and Escherichia coli (a specific type of coliform) were better able to predict illness among swimmers.[4]

Gastroenteritis is the most common waterborne disease and is caused by a virus which is probably highly infectious and highly concentrated in sewage. A high rate of attack is associated with a low concentration of enterococci. Densities of 10 per 100 ml represent a 1 percent attack rate or about 10 cases per 100 swimmers.[5]

FIGURE 1.



Upper Narragansett Bay and Providence River Beaches

Sand beach and spit

From New England Basins Commission, 1977; Rhode Island Statewide Planning, 1976; Dr. J. Boothroyd, URI

TABLE 1.
Upper Narragansett Bay and Providence River Beaches

	Beach	Town	Ownership	Length (miles)
1	Rocky Point	Warwick	Private	0.04
2	Highland	Warwick	Private	0.06
3	Bayside	Warwick	City	0.50
4	Conimicut	Warwick	City	0.20
5	Gaspee Point	Warwick	Private	0.08
6	Sabin Point	E. Providence	City	0.15
7	Crescent Park	E. Providence	Private	0.11
8	Narragansett Terrace Park	E. Providence	Private	0.10
9	Annawamscott	Barrington	Town	0.02
10	Tillinghast Farm	Barrington	Private	0.40
11	Barrington Town	Barrington	Town	0.20
12	Beach Road	Barrington	Private	0.10
13	Meadowbrook	Barrington	Private	0.05
14	Barrington Yacht Club	Barrington	Private	0.05
15	Warren Town	Warren	Town	0.05
16	Narragansett Heights	Bristol	Private	0.02
17	Bristol Town	Bristol	Town	0.20
			Total Public	1.32
			Total Private	1.01

Enterococci were measured in the Upper Bay about three years ago, but no studies have been done since the Field's Point Plant resumed effective primary treatment. With effective disinfection at all the sewage plants, the primary source of pathogens is probably the combined sewer overflows and the rivers. Proposed plans for satellite treatment of combined sewer overflows would provide disinfection for the Providence overflows, as described in the shellfish chapter. Controversy surrounds this treatment because of possible effects on fish and shellfish larvae. Unfortunately, viruses such as the types which cause gastroenteritis are thought to be more resistant to chlorination than coliform bacteria. Thus high levels of disinfection are required to reduce viruses.

Aesthetic considerations

The appearance of a beach may do more to determine its use than the actual water quality. Debris on shore results from litter left by users and floating material left by the tides. The sources of this floating material are most likely litter from other parts of the Bay, rivers, combined sewer overflows and storm drains. The relative importance of these sources is unknown.

Another aesthetic consideration is odor. When oxygen is depleted, a different type of bacteria multiply in the sediment. Instead of oxygen, they metabolize sulpher and produce foul smelling hydrogen sulfide gas. Low oxygen is a problem in the Providence River during mid summer and is described in more detail in the shellfish section. It is one aspect of water quality which has been successfully managed through treatment facilities and nutrient control in other locations. While we do not currently have information necessary to apply state of the art techniques to the Providence River, sampling being conducted this summer by Dr. Nixon of URI should help make such management possible.

Water Quality Goals for Swimming

A range of possible goals for swimming include the following:

1. Make swimming a high priority use in the Upper Bay and Providence River. Expand access by creating sandy beaches and acquiring beach areas currently in private ownership. Establish disinfection policies which will protect swimmers in all beach areas throughout the Providence River.

2. Maintain the use of current beach areas and encourage swimming in the lower Providence River, but do not expand northward in the Upper Providence River or Seekonk River. Tailor disinfection procedures to protect swimmers south of Sabin Point.

3. Do not recommend swimming at beaches in the Providence River, concentrate on expanding access in the Upper Bay, and disinfect accordingly.

4. Provide alternate swimming opportunities which do not require swimming quality water in the Providence River. Possibilities include public salt water pools along the shore.

Potential conflicts which must be resolved center around the necessity to disinfect effluents or accept a high gastroenteritis attack rate versus the deleterious effects of disinfectants on fish and bivalve larvae.

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4. HOW DOES WATER QUALITY LIMIT RECREATIONAL BOATING OPPORTUNITIES IN THE UPPER BAY, PROVIDENCE OR SEEKONK RIVER?

Recreational boating constitutes a major use of Narragansett Bay. Direct access to the Upper Bay is provided by twenty-four marinas, yacht clubs and boat clubs located in the sheltered coves of the Upper Bay and Providence River and on the Seekonk (Figure 1 and Table 1). Boat launch ramps are listed in Table 2.

The Upper Bay area has been identified as the area with the best potential for marina and boating growth in the state.[1] Problems which affect an expansion of boating activity include site acquisition, site development, conflicts with established uses such as industry and shipping, dredging needs, water quality and shoreline debris. The industrial activity in the Providence River does not preclude recreational boating. Boston, San Francisco, Vancouver and many major port cities have boating facilities interspersed with commercial shipping facilities.

A study conducted in 1974 catalogued 2,277,000 man-days of boating per year in Rhode Island registered boats with some form of power. While Rhode Islanders were satisfied with their boating experience overall, the following statements were identified by owners of both power and sailboats as indicating the most important factors detracting from boating enjoyment.[2]

1. Boating is getting too costly.
2. Water pollution messes up my boat.
3. Can't go for a swim because of pollution.
4. Too many other boats.

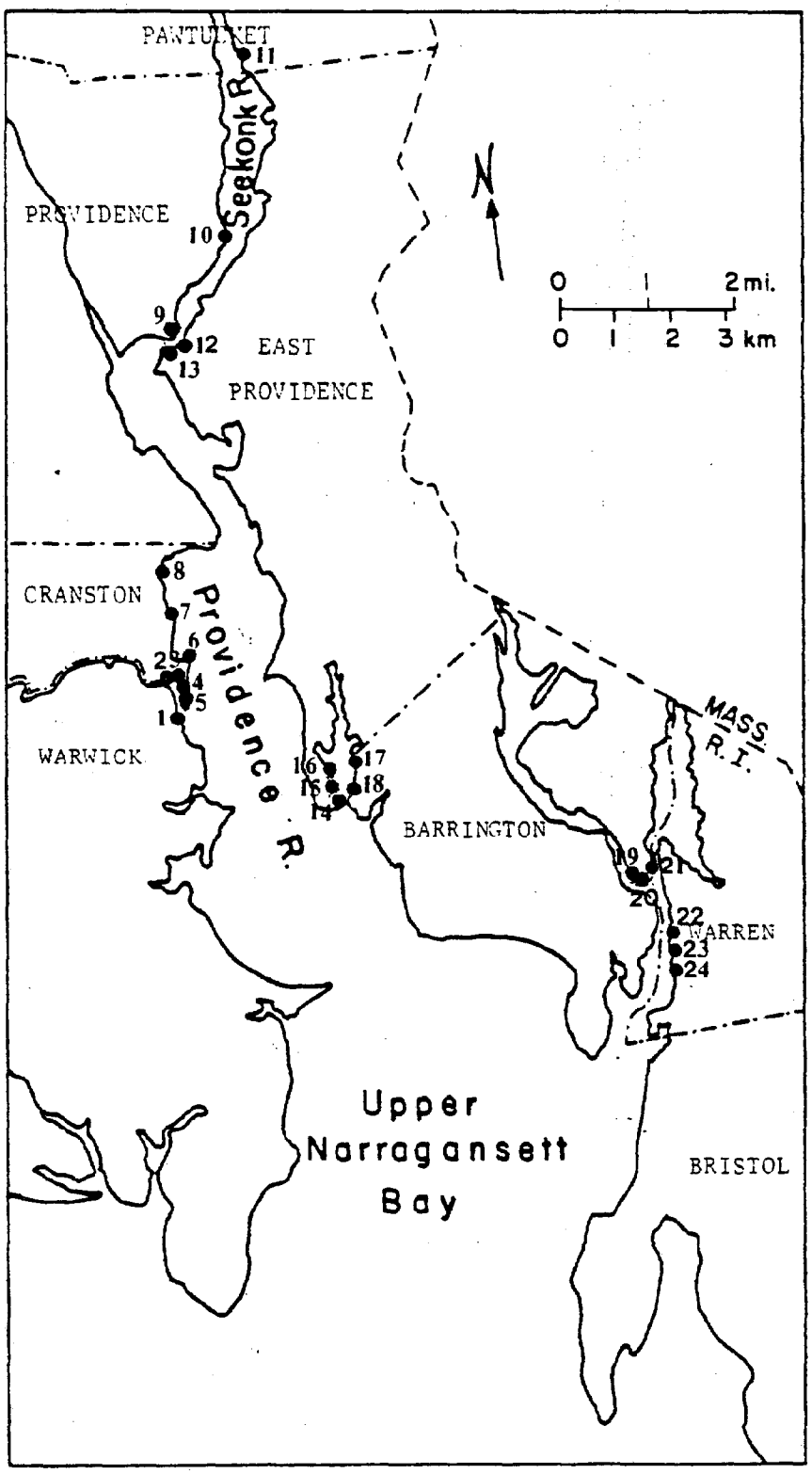
Two of these issues relate to water quality.

Public Health Concerns

Public health concerns are a relatively minor issue in terms of protecting recreational boaters. Class SC water is judged suitable for recreational boating according to the state classification. There are no specific numerical criteria for coliforms under this classification, although they are limited to "none in such concentrations that would impair any usages specifically assigned to this class." It can be argued that since the risk to public health would be limited to people falling overboard, the presence of human pathogens presents a low risk to boaters. However, when swimming is combined with boating or when small, easily capsized sailboats or rowing shells are in use, then the same public health concerns discussed in the swimming chapter apply.

Recreational boating is not a totally benign use in terms of public health or effects on the environment. A debate is raging over the disposal of human wastes from marine toilets. Traditionally, recreational boats have discharged sewage directly into the water. However, the federal government

FIGURE 1.



MARINAS, YACHTCLUBS AND BOAT CLUBS

TABLE 1.

Marinas, Yacht Clubs and Boat Clubs in the Upper Bay and Providence River

Location	Facility	Slips (1979)	Moorings
Pawtuxet	1. Pettis Marina	16	9
	2. Pawtuxet Athletic Club		
	3. Edgewood Marina	45	
	4. Pawtuxet Cove Marina	70	
	5. Pawtuxet Yacht Club	18	
Edgewood	6. Rhode Island Yacht Club	13	7
	7. Edgewood Yacht Club	56	25
	8. Port Edgewood	120	
Seekonk River	9. Brown University Boathouse		
	10. Narragansett Boat Club		
	11. Parents Marina		
	12. Oyster House Marina	36	
	13. East Providence Boatyard		
Bullocks Cove	14. Bullocks Point Marina	73	
	15. Narragansett Terrace Marina	25	30
	16. Narragansett Terrace Boat Club		
	17. Cove Haven Marina	230	
	18. Lavin's Marina	150	
Warren River	19. Stanley's Boatyard	220	57
	20. Barrington Yacht Club	76	117
	21. Striper Marina	116	
	22. Water Street Dock	16	
	23. Ressler's Marina	20	10
	24. Sousa's Shellfish	30	

Source: Collins and Sedgwick, 1979, Recreational Boating in Rhode Island's Coastal Waters: A Look Forward. URI Marine Technical Report 75.

TABLE 2.
State and Municipally Owned Launching Facilities in the Upper Bay

Location	State	Municipal
Barrington	Haines Park	
Bristol	State Street Colt Park	
Cranston		Aborn Street
East Providence		Bold Point Sabin Point Beach Road
Warwick	Longmeadow Gaspee Cove Conimicut Point	Edgewater

Source: Collins and Sedgwick, 1979. Recreational Boating in Rhode Island's Coastal Waters: A Look Forward. URI Marine Technical Report 75.

through the Federal Water Pollution Control Act (FWPCA Section 312) is attempting to change that by requiring that all vessels with permanently installed toilets be equipped with one of three types of marine sanitation devices. Types I and II treat the wastes through a combination of maceration and chemical treatment. The treated wastes are then discharged into the water. Type III devices do not discharge into the water and usually involve a holding tank from which the wastes are removed at a shoreside pump-out station.

The requirement for installing marine sanitation devices has been postponed and cancellation of the requirement is being considered. There is disagreement both as to the effectiveness of the designed toilets and to the need for treatment of wastes from boats. Those who argue that waste need not be treated usually cite the dilution provided by the large amount of water in estuaries such as Narragansett Bay. Dilution is often insufficient, however, in the small sheltered coves where marinas are located and where boaters drop anchor. The chemical treatment toilets have been critized as ineffective at disinfection and for adding chemicals to the water which may be harmful themselves. Holding tanks prevent discharges completely but there are only three pump-out facilities in Rhode Island (1979), one of which is in the Upper Bay at Stanley's Marina in Barrington.[1]

The state water classification system recognizes the local impacts of marinas by establishing the class of SAm. This class includes marinas and anchorages where boats are docked or moored from June 1 to September 30. Shellfish harvest (without depuration) is prohibited in these areas during the summer, but permitted from October 1 through May 31.

Aesthetic considerations

Water quality which is poor because of floating objects, litter or oil interferes with a pleasurable boating experience. Litter is generated by boaters themselves, by other waterfront users and in the Upper Bay may result from combined sewer overflows or storm drains which are unscreened. Floating litter is probably not sufficient in itself to prevent boaters from frequenting an area if the location is attractive for other reasons. A prime example is Newport Harbor, one of the most popular cruising stops in the northeast, which is nonetheless plagued with litter and floating debris.

Odor is another aesthetic consideration related to water quality. When oxygen is depleted, bacteria which can survive in the sediment produce hydrogen sulfide gas. Low oxygen concentrations occur in the Upper Bay and especially in the Providence River during the summer. Data is being collected this year which will help to define the relative importance of the various sources of the problem: organic matter and nutrients from rivers, sewage treatment plants, CSOs, storm drains and runoff.

Management Issues

While water quality should not be ignored, the health of recreational boating in the Upper Bay, Providence and Seekonk Rivers probably depends

more on a host of other factors. Lack of dock space and boat ramps, hazards to navigation from submerged debris and a poor public image of the area are probably more limiting than water quality. Expansion of many existing facilities is limited inland by insufficient parking space and in the water by dredging needs. Expansion may create conflicts between different types of boaters, such as rowers and power boats. Creating a hospitable climate for recreational boating will be aided by clean water, but that will by no means be sufficient.

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CRC

A REVIEW OF THE CITY OF PROVIDENCE INDUSTRIAL WASTEWATER PRETREATMENT PROGRAM PRETREATMENT LIMITATIONS STUDY

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A REVIEW OF THE CITY OF PROVIDENCE INDUSTRIAL WASTEWATER PRETREATMENT PROGRAM PRETREATMENT LIMITATIONS STUDY

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INTRODUCTION

The Proposed Pretreatment Program The City of Providence is required to prepare an industrial pretreatment program as part of its obligation to meet the 1983 federal requirements for treatment plants which discharge more than 5 million gallons per day and handle industrial waste. Charles Krasnoff Associates was contracted by the City to meet this requirement by developing an industrial wastewater pretreatment program by August 13, 1982. The purpose of this report is to summarize the findings and conclusions of the study, critically examine the logic and supporting evidence presented to justify those conclusions and discuss the basic issues which must be resolved before the proposed pretreatment program can be taken as a serious attempt to address one of the major pollution concerns in Upper Narragansett Bay.

The objective of the pretreatment program is to establish discharge concentration limits for individual firms which dump industrial pollutants such as wastewater from metal finishing operations into the Providence sewer system. It is based on three concerns:

* protection of the treatment works
* protection of the quality of the receiving waters
* protection of the quality of sludge produced by the sewage treatment plant to permit safe disposal

The industrial pretreatment study proposes maximum allowable discharge concentrations for nickel and copper. The nickel limit is aimed at allowing the Inge Corporation to process and dispose of sludge from the reconstructed Fields Point plant. The copper limit is aimed at lowering copper levels in the Providence River to below EPA chronic pollution levels. Oil and grease, and ph limits are proposed which would protect plant processes.

Goals of this Review The challenge which the Industrial Pretreatment Study presents to the reader is twofold. First, it is important to understand how the authors of the study reached their conclusions based upon the data and analysis presented in the text. This was not an easy task for the reviewers. Secondly, it is crucial to examine the quality of the data, the accuracy of computations and the reasonableness of the assumptions which are made throughout the report. These were found lacking in many respects.

Our assessment is presented in three parts. The first is an analysis of the route by which the conclusions are reached. We have identified key premises, tables of data and critical assumptions. The second part consists of more detailed assessments of the individual premises which comprise the argument used to arrive at the proposed discharge limits, focusing on major issues which require explanations or reexamination. The final section contains broader comments on the scope and approach of the study as a whole to the problem of industrial discharges into the Providence sewage system.

THE PROPOSED INDUSTRIAL DISCHARGE LIMITS

It is essential to understand just how the proposed limits for nickel and copper concentrations were established in the study, and why standards for no other metal, or petroleum hydrocarbons, were developed. A flow diagram of the logic of the analysis was prepared and is presented in Figure 1. The boxes represent a determination of a concentration of a metal in either the waterbody, sludge or treatment plant influent or effluent. The circles represent crucial assumptions or operations which are performed to get from limits on metals in sludge or receiving water to limits on industrial discharges. Question marks appear at points where the analysis presented in the study was confusing or not fully discussed in the text.

The study calculated maximum allowable concentrations of metals which could be allowed to enter the sewage treatment plant from three different perspectives, and selected for each metal the strictest of the three concentra-

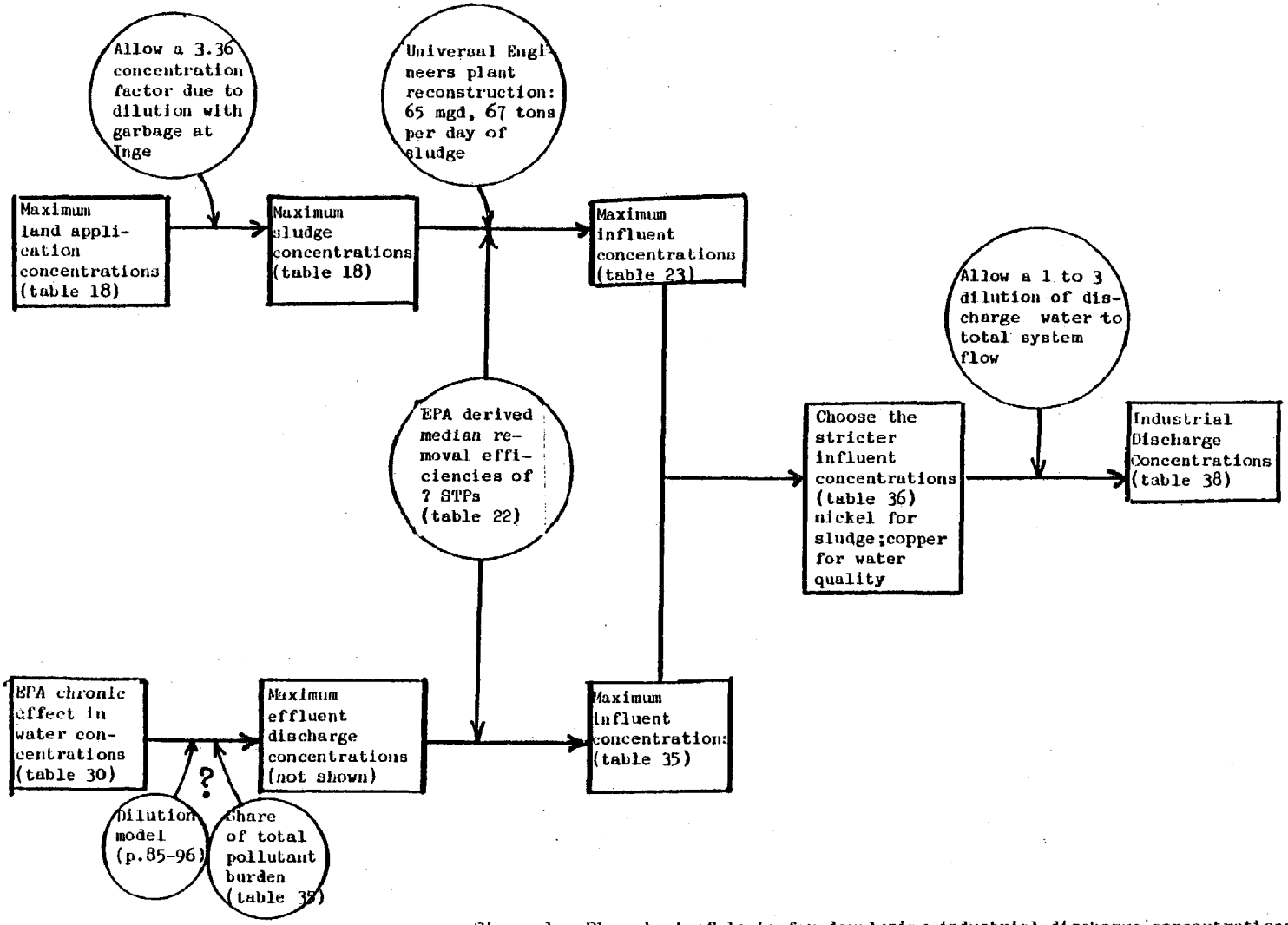

Figure 1. Flow chart of logic for developing industrial discharge concentrations

tion levels. For nickel, limits which would protect sludge quality were the strictest, so a maximum plant influent level for nickel of .52 milligrams per liter was selected. For copper, limits which would reduce levels of copper in the receiving water were the strictest resulting in a requirement for influent of .95 milligrams per liter. No metal limits were based on protection of the plant alone.

As Figure 1 shows, the process of computing the maximum allowable concentrations of metals in the influent for protecting the quality of the sludge began with the Rhode Island Department of Environmental Management's sludge concentration limitations for the land application of sewage sludge. These values were increased by 3.36 times due to the fact that the Inge process of mixing sludge with garbage would in effect dilute the sludge. Therefore, it could safely be more laden with metals. The maximum allowable concentration of metals in sludge from the reconstructed treatment plant was computed and shown in Table 18 of the study. The maximum concentration of metals in the influent of the treatment plant which would yield this allowable sludge concentration was computed by assuming the design parameters of the rebuilt plant currently proposed by Universal Engineers. Key assumptions are that an average of 67 tons per day of dewatered sludged would be produced, average flow would be 65 million gallons per day, and that the proposed plant design would result in a performance exactly matching the EPA derived median removal efficiencies for sewage treatment plants (whose type or description are not discussed in the report). Plant influent limits were also calculated for landfilling and land disposal of sludge without Inge dilution (Table 23), but these figures were ignored in calculating industrial effluent limits.

The technique for computing maximum allowable concentrations based on the quality of receiving waters was more complex and confusing. This analysis began with EPA chronic effect concentration levels for receiving waters, presented in Table 30. The study then presents a simple model of the fate of a substance such as salt in a non-tidal water body, called a 'dilution'

model on pages 85 to 96 and Table 35. The quantities of metals released from the plant in 1981 were run through the model to see if any reached levels of concern in any location. Since this is a dilution model, the locus of greatest concentration is at the outfall. In the case of copper and nickel, levels of concern were found in the computations. The study then assumes a given contribution of the total metal load to the Providence River from the treatment plant for each metal, and computes the maximum amount allowed to be discharged from the outfall which would eliminate the violation of chronic levels in the water. The result of these calculations are not presented in the report. However, maximum influent limits for water quality concerns are presented in Table 35.

The next task which the study undertakes is to select final influent concentration limitations. This is done by choosing the stricter of the three approaches to influent concentrations, and is presented in Table 36. As it turns out, with the exception of copper, sludge protection is the most limiting criteria. Nickel limits were selected as the only important problem in this regard. Copper limits were selected as the only water quality criteria of concern.

The final step was to allow for the assumption that the estimated 17 million gallons per day of industrial flow would be diluted by a factor of three due to residential and commercial flow, and infiltration and inflow along with seawater intrusion. Thus the maximum allowable industrial discharge concentration of copper and nickel were three times the strength which the study found permissible in the water which reached the sewage treatment plant.

CRITIQUE OF KEY ASSUMPTIONS

The Industrial Pretreatment Study is very sensitive to variations in several major assumptions. Many of these assumption are questionable. Many more pollutants should have discharge limits developed, including petroleum hydrocarbons. The dilution effect of infiltration and inflow on industrial

discharges is very important yet not approached conservatively.

The EPA median removal efficiencies for treatment plants play a key role in judging how well the reconstructed plant will do, although no discussion of the validity of these removal rates is supplied. In the development of maximum influent concentrations permissable to protect the sludge, heavy reliance is placed on the assumption that the Inge process will be the chosen disposal option, despite the present dispute over the cost effectiveness of that approach. The maximum influent concentrations to protect water quality are based on a confusing line of argument which relies on a simplistic and inappropriate dilution model rather than an assessment of available data about pollutants in the water, sediment and organisms of Narragansett Bay to select priorities.

Restriction on the Number of Metals for Which Limits are Imposed

The jewelry industry is currently operating at 40 percent capacity. Therefore at full capacity, metal loadings could increase by 150 percent. Metals such as zinc and cadmium, which Krasnoff calculations indicate are currently present in concentrations near the sewage treatment plant influent limits proposed by Krasnoff (Table 36) would very probably exceed those limits. Since it is in the interest of the industry to provide predictability in the regulatory process, limits should be proposed at a minimum, for all metals which could become a problem under full industry operation. It would make even more sense to propose limits for all metals. No action would be necessary by industry for metals currently in compliance but guidance would be in place in the event that new processes or industries generate higher concentrations in the future.

Even if we can accept the assumptions and methods used in the report, Krasnoff's own calculations (Table 36) imply that limits should be imposed on cadmium and zinc and possibly lead in addition to copper and nickel.

The limits proposed in the summary and conclusions are presumably based on future water use and elimination of tidal flow to the STP (industrial water use = 24 percent) as opposed to current conditions (industrial water use = 27 percent) used in CKA Table 38. If future water conditions are applicable, then certainly the metal concentrations generated under those conditions are also applicable. Therefore, instead of establishing the need for limits by comparing present concentrations (column H) to Krasnoffs' proposed criteria (column G), the report should compare projected concentrations under future water use (column I) to the criteria. When this is done, cadmium and zinc are also in violation. Since the Inge process will probably not be used, a case can be made for comparing column I to column F, which considers sludge without dilution. Under this comparison, lead would also be in violation. The decision on what metals are to be limited should also be based on evidence for current problems. Shellfish sampled at Conimicut Point contain chromium in excess of proposed FDA alert levels. Therefore, chromium should certainly be subject to pretreatment limitations.

Lack of Attention to Petroleum Derivatives

Petroleum hydrocarbons and toxic organic chemicals should be considered in the report. "Oil and grease" limits are proposed in the report based exclusively on concern for the clogging of pipes. Effects on the receiving water quality are not mentioned. There is evidence that petroleum hydrocarbons are a major problem in Narragansett Bay sediments and in the water column in the Providence River. According to a budget developed by Dr. Eva Hoffman, approximately 47 percent of the oil inputs to the Upper Narragansett Bay watershed originate in Providence sewer system. Dry weather CSO flows contribute 33 percent of the total and the Providence sewage treatment plant contributes 14 percent (other sources are: runoff, 36 percent; other sewage treatment plants, 12 percent; direct industrial discharges, 4 percent; oil spills, 1 percent; and atmospheric fallout, 1 percent.)

Industrial Flow Levels and Dilution Effect of Infiltration Inflow The study makes a key assumption which greatly affects the final discharge concentration values. It is assumed that infiltration and inflow will compose a constant 30 million gallons per day, or almost 50 percent of daily average flow in design year 1983. This value represents the peak estimated inflow value which would apply only under the wettest conditions rather than 17.9 million gallons per day which Universal Engineers cites as a minimum value. While is is appropriate for Universal to design the plant for this maximum inflow rate it is questionable whether maximum dilution should be assumed for industrial waste. Krasnoff's final recommended limits (p. 107-108) seem to be based on the assumption that future conditions will provide even greater dilution of industrial waste. The scenarios presented on p. 102 includes a reduction of 25 percent in industrial water use without any conservation by commercial or residential users. As a result of this approach a much more concentrated industrial discharge is permitted (see Table 1) In addition, conversations with engineers knowledgable of the current project indicate that even the minimum inflow/infiltration value may be exaggerated.

A broader problem is the lack of an industrial perspective. Industrial water usage data, and information on typical firm discharges are not supplied. Discussions of the future of the metal finishing industries and best available treatment or reclamation practices which set the boundaries on industry's ability to achieve reductions are absent. Salt water intrusion is stated to be less than 3 million gallons per day, which may be unrealistically low based upon recent assessments of plant flow data and tide gate problems. An extensive analysis is made of the potential contribution of a small number of industrial discharges who may shut down in early July, stating that 3.8 mgd of flow contributes 63 percent of the total load of all metals. However, the accuracy of flow meter readings at the treatment facility may be much worse that $\pm$ 3 mgd. No

Table 1. EFFECT OF WATER ASSUMPTIONS ON METAL LIMIT CALCULATION

Source of flow	Flow using maximum infiltration and inflow 1983	% flow	Flow using minimum infiltration and inflow 1983	% flow
Residential	7.92	12.9	7.92	16.0
Commercial	6.64	10.8	6.64	13.4
Industrial	16.99	27.6	16.99	34.4
Infiltration & Inflow	29.90	48.7	17.90	36.2
TOTAL	61.45		49.95	

	% of flow from industrial	Limit for 4-day consecutive average (mg/l) Ni	Cu
CKA proposed limits Table 38	27	1.9	3.3
CKA proposed limits p. 107-108	24*	2.1	3.7
limit based on minimum infiltration inflow**	34.4	1.5	2.0

*2003 design flow minus 2.59 mgd tidal inflow and 25% industrial water use conservation (p. 102). Use of 24% is presumably the reason the final recommendations differ from those calculated earlier.

**Using CKA equation in Table 38.

Disadvantages: requires double handling of debris
cost allocation harder to determine
collection site must be located
less resistant to failure of project, i.e. nonpayment of hauling costs by owners, or lack of management and oversight
collection sites may attract unwanted garbage and trash

d. Questions for discussion

(1) Which is cheapest?

(2) How can a fair allocation of hauling costs be made?

(3) Which is most resistant to failure?

(4) Which sites would be most effectively handled separately?

specific estimate is made of the number of workers actually out of work during the period of comparison or the effect of the recession on the industry on flow rates and output.

Median Removal Efficiency Assumption

EPA median removal efficiencies should not be assumed for the future Providence sewage treatment plant without justification. If these medians reflect data collected for new sewage treatment plants not yet treating their entire design flow or for plants which do not receive metal loadings as high as those in Providence, they could have little applicability to the Providence Plant. Krasnoff has stated that since the plant's present performance is often poor, current removal levels are lower than those which should occur under future conditions. EPA medians, Providence medians and Providence ranges are compared in Table 2. Providence removal efficiency for cyanide is better than the EPA median, but all other constituents were removed at a lower median efficiency. With the exception of chromium and mercury, Providence's median removal efficiencies were less than 40 percent of the EPA medians.

It is also informative to consider the range of removal efficiencies. A median by definition implies that half the values are greater and half lower. In the case of chromium, copper, zinc, and cadmium even the maximum removal efficiency achieved by the Providence plant is lower than the EPA median, indicating that even the best performance for 1980 through July 1981 was inferior to the prediction. With the exception of cyanide, there were months of no removal or negative removal in every case. A spot check of nickel removals for the last 6 months of data available (Sept. 81- Feb. 82) from DEM indicates one month with a positive removal (1.7 percent) and five months of zero or negative removal.

The use of EPA median removal efficiencies to back calculate from permissible plant effluent limits to permissible influent limits in the

TABLE 2. COMPARISON OF EPA MEDIAN REMOVAL EFFICIENCIES AND THOSE ACHIEVED BY THE PROVIDENCE PLANT

	EPA median removal efficiency[1] %	Providence median removal efficiency[2] %	Providence range of removal efficiencies[2] %
Cr	75	43.9	- 50-77.0
Cu	82	31.2	- 138-77.5
CN	54	81.8	11.6-97.0
Pb	55	19.8	0-75.0
Hg	55	43.4	- 250-77.0
Ni	32	5.3	- 116-59.4
Ag	81	22.7	- 50-89.5
Zn	80	26.7	-1200-76.3
Cd	90	20.0	- 100-66

[1] from CKA Table 22

[2] Monthly samples from 1980 and Jan.-Aug. 1981, from CKA Tables 5 & 6

calculations performed by Krasnoff may seriously underestimate the metal concentrations in sewage plant effluents, and hence in the receiving waters. EPA median removal efficiencies are also used to modify the proportion of total loadings to the Providence River from the Providence Plant (Table 35), assuming that 80 percent are currently from that source (p. 97, no reference given). This modified proportion of metal loadings is used in calculating influent limits (Table 35).

Sludge Data and Handling Options

The recommended limitations are based on the assumption that metal concentrations in the sludge will be diluted by the Inge composting process. Since the Narragansett Bay Commission will not necessarily utilize this method of sludge disposal, pretreatment limitations should be based on levels compatible with sludge treatment processes and disposal options being considered by the Commission. The approach used to develop limits in the pretreatment report is based on the assertion that sludge concentrations of metals will be related to those in the STP influents. This is supported by correlations developed in CKA Table 19. Much data (presented in CKA Tables 5, 6 and 8) is excluded from the table 19 calculation, with no reason given. If data were excluded due to plant malfunction, one would assume that all metals would be similarly affected on any one sample data. However, there is no date for which all data is either included or excluded and much of the missing data represents dates with low influent concentrations and high sludge concentrations. When all the data is included in the calculations, the correlations for copper, cadmium, and nickel become negative, indicating an inverse relationship between metal concentrations in sludge and influent. Correlation coefficients become low for all metals. If sludge is recycled within the plant to a varying degree dependent on production rates, why would one expect a correlation with influent concentrations?

Dilution Model and Development of Influent Standards Based on Water Quality

Plant influent limits based on water quality criteria are presented in Table 35 for chromium, copper, nickel and zinc. Presumably limits are not developed for other metals due to lack of information on the proportion of the total load due to the Field's Point sewage treatment plant.

The logic behind the equation used to calculate these limits (Table 35) is not presented and is not clear. Plant effluent limits are not specifically calculated; the calculation in table 35 translates EPA chronic values into plant influent levels in one step. In addition to the assumption that EPA median removal efficiencies will apply to the reconstructed Providence plant, the calculations are based on a projection of the proportion of the total metal loadings due to the Providence plant and a salt dilution model.

Eighty percent of the total loadings of chromium, copper, nickel, and zinc are attributed to the Field's Point plant (p. 97, no reference). This percentage is then modified using the assumption that metals will be removed at EPA median efficiencies to produce a lower, future percentage.

The eighty percent figure may be drawn from Table 29, which lists the major sources of trace metal inputs from wastewater discharges to Narragansett Bay in 1977. Field's Point was responsible for from 73 to 87 percent of the total municipal input of copper, chromium, zinc and nickel. These numbers represent, however, the proportion of inputs to the entire Narragansett Bay, not merely the Providence River as considered by the dilution model. Other sewage treatment plants are listed as the major sources of lead and mercury in 1977, but it should be noted that this does not exclude the Field's Point plant as a major source, since no data was available for Field's Point. It is also important to note that the Table 29 figures represent a proportion of wastewater discharges only, not a proportion of the total loadings,

which would include CSOs and storm drains. There appears to be no basis for restricting water quality considerations to only four metals and the projections to a proportion of future loadings appear unjustified.

The dilution model used to predict concentrations of metals in the Providence River has many shortcomings. As such it is non-tidal, one dimensional and limited to conservatively mixed substances.

The model ignores the effects of tides, which can move pollutants upstream from the Field's Point outfall on a rising tide and back downstream to mix with new effluent on an ebb tide. Thus the water which mixes with the effluent may already contain considerable concentrations of metals. As presented, the model assumes that the water available to dilute the effluent contains no metals at all. This would not be true even in mid-ocean. The net result may be higher concentrations of metals than predicted by the model, due to this concentrating affect of the tides.

The model is one-dimensional and thus ignores the effects of stratification of the water column. While most of Narragansett Bay is well mixed, in the Providence River, fresh water from river input often layers on top of more dense salt water. This lack of vertical mixing may result in higher concentrations of pollutants at certain depths. If pollutants enter with fresh water, they may be concentrated in the surface layer and undiluted by the underlying salt water. Thus the water concentrations could be higher in surface waters and lower at depth than predicted by the model. The model applies to "conservatively mixed" pollutants, meaning those which are neither added nor removed during the dilution. The metals of interest as pollutants are <u>not</u> conservatively mixed. A large amount rapidly disappears from the water column and is incorporated into the sediments. This implies that the water concentrations could be lower than those predicted by the dilution model, but sediment concentrations

may be high. Army Corps of Engineers data and other sampling indicate elevated levels of many metals in upper bay sediments. Little information is available to determine when concentrations of metals in sediments become harmful, but a case can be made that where the metals are bound strongly to the sediment, they are less harmful there than in the water column.

High concentrations in the sediment will affect the concentrations in the overlying water. In experiments conducted at the URI Marine Ecosystems Research Laboratory (MERL), sediment from the upper bay was placed in large tanks with clean water above it. Metals moved from these sediments into the water. This implies that even if all metals were removed from the Field's Point effluent, the sediments would still act as a source of metals to the water. This effect is small compared to current metal loadings, but is ignored in calculating metal concentrations which would result from reduced Field's Point effluent.

It may not be feasible at this time to use a circulation model to predict metal concentrations in the Providence River, although Dr. Malcolm Spaulding of URI is developing just such a model to predict coliform concentrations. At a very minimum, however, the model equations should be modified to include ambient metal concentrations; of those which could come out of the sediments, and if possible, those due to tidal concentration at the head of the bay.

GENERAL COMMENTS

Without redoing the study ourselves, it is not possible to conclude whether a particular discharge limit should be stricter or more lenient. Our first concern is that a reasonable approach must be taken to assess the problem, that the study clearly state and justify all assumptions, utilize all of the available

data on the metal and petroleum hydrocarbon pollution problem in Narragansett Bay, and make consistently conservative judgments in establishing discharge limits. We also recommend that a complete narrative accompany each step in the analysis, since the report proved to be incomprehensible in several places even for patient and experienced professionals.

A number of questions are raised by what fails to appear in the study. Virtually no description of the metal finishing industry is provided, including its employment levels, economic problems and particularly its technical capability to reduce discharges. The reader is left with no idea whether most or all firms presently meet the discharge concentration levels, and whether a two or three-fold improvement in pollutant reduction could be achieved at an acceptable cost. Serious consideration deserves to be given to the concept that industry achieve 'best practicable' control levels, which might bring ambient water concentrations well below chronic for just a few dollars more.

In sum, many of the numbers currently incorporated in the calculation of industrial effluent limits represent factors which may be expected to vary even under ideal plant operating conditions. For instance, treatment variations will generate varying removal efficiencies; varying water use and infiltration/inflow will create different degrees of dilution in the sewer lines; changing industry economics will generate varying levels of production. At present, all of these are factored into the calculations at the most favorable levels possible in terms of producing an effluent with low metal concentrations: high metal removal efficiency at the plant, low industrial water use and high infiltration/inflow, and low industrial production. In addition to these variations, metal toxicities also vary drastically both due to synergistic and antagonistic effects and parameters such as pH. Although synergistic effects are discussed in section IV they are not considered in setting limits.

Metal limitations should be prepared in a way which acknowledges the range of these variations and clearly delineates how each is incorporated into

the recommended limits. The current approach certainly leaves no margin for error for variation which is bound to occur.

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DEBRIS REMOVAL IN UPPER NARRAGANSETT BAY

Introduction

One of the legacies of port development in this century is the presence of a large amount of floating and shoreline debris. Dilapidated wharves and piers, some abandoned, others damaged by hurricanes, are the main sources of this debris. Abandoned and wrecked barges and scows also contribute to this problem. Shoreline debris is a hazard to navigation, detracts from the visual quality of the shore and water, and restricts commercial redevelopment of the urban waterfront. Debris removal is widely recognized as beneficial to both the public and private sectors.

The New England Division of the Army Corps of Engineers completed a draft feasibility report on debris removal in Providence Harbor in 1978 as part of its program to implement responsibilities under the 1889 Rivers and Harbors Act. The present program was authorized by Section 202, of PL 94-387, the Water Resource Development Act of 1976. However, the Corps New York division is already in the midst of an active debris removal project at present. A look at that project provides some idea of how the Providence project would operate when it is finally undertaken.

Since 1915 the Army Corps of Engineers has been collecting floatable debris from the waters of New York Harbor. In 1974, a report was submitted by the Corps to the Department of the Army that showed the need for attacking the problem of floating debris at its source: the dilapidated wharves and piers around the harbor. The program was approved by the Army and funded by Congress in 1975.

The cost-sharing scheme in the New York project is 2/3 federal, 1/3 non-federal, and all debris sources are eligible for federal cost-sharing funds. This includes debris sources for which owners can be identified.

The Corps of Engineers' role in the New York project is that of an administrator, as it would be in a Providence Harbor project. When non-federal money is raised for removal of debris sources (this money comes from both public and private sources), the Corps matches it with the federal funds which have been appropriated by Congress. The Corps then solicits bids for the work from private contractors, and monitors the work as it progresses.

According to the New York division of the Corps, approximately 20 percent of the total debris sources have been removed so far. The total cost of the project is estimated at $90 million for the 750 miles of shoreline in New York Harbor.

Another debris removal program is in the approval stage, concerning Boston Harbor. A final feasibility report was completed for Boston by the Corps in 1979, and revised in 1980. It is being reviewed by the Department of the Army before being submitted to Congress for authorization and funding.

The major difference between the New York project and the Boston and Providence projects is the cost-sharing arrangement. All debris sources are eligible for federal cost sharing funds in New York; in Boston and Providence, the cost sharing will apply only to sources of debris for which the owner can't be identified. Non-federal interests will have to recover the costs of removing debris sources for which the owner can be identified. Governor King of Massachusetts supports the Boston debris-removal project, but is seeking legislation to change the cost-sharing arrangement so as to reduce the State's share of the costs.

Status of Providence River Project

The Providence River and Harbor and Seekonk River Debris Study, as the feasibility report is entitled, is still in the draft stage. Work to complete the study is scheduled to resume in October, 1981. The most recent draft report was completed in January of 1978. Using the information from the 1978 draft, approximately 25 percent of the total projects costs of $4,857,364 will be borne by the federal government under the present cost-sharing scheme (Table 1). This represents $1.2 million against a non-federal share of $3.6 million. Fifty-eight percent of the non-federal share or $2.7 million would possibly be recovered from private property owners. Table 2 shows total volume and 1978 costs for each municipality in the study area.

The Corps draft report proposes several alternative plans for removal and disposal of the debris. Based on benefit-cost

	Entire Study Area (dollars)	Providence Harbor and River (dollars)
Federal Share	1,225,312	871,243
Non-Federal Share:		
Recoverable	2,687,785	2,117,711
Non-Recoverable	944,266	684,364
Total Non-Federal Share	3,632,051	2,802,075
TOTAL	$4,857,364	$3,673,319

Table 1: Estimated 1981 Cost for Debris Removal in Upper Narragansett Bay and Providence Harbor.

(Estimated from 1978 Figures developed by New England Division, Army Corps of Engineers)

	Eligible Debris	Total Debris	Percent of Debris Eligible for Federal Cost Sharing
Barrington	2,033 ft^3	4,694 ft^3	43%
	$9,879	$26,041	40%
East Prov.	113,303 ft^3	256,647 ft^3	44%
	$436,483	$1,005,625	43%
Pawtucket	210 ft^3	12,886 ft^3	2%
	$1,061	$73,608	1%
Providence	156,328 ft^3	376,946 ft^3	41%
	$628,690	$1,498,048	42%
Cranston	22,732 ft^3	29,342 ft^3	77%
	$92,269	$122,206	75%
Warwick	10,764 ft^3	14,108 ft^3	76%
	$44,558	$62,439	71%
TOTAL VOLUME	305,370 ft^3	694,623 ft^3	
TOTAL COST	$1,212,940	$3,787,967	

Table 2: Proportion of Debris Eligible for Federal Cost Sharing in Upper Bay Communities. Source: 1978 Corps of Engineers Study

ratios, evaluation of negative impacts, and on the feasibility of each plan's disposal methods, a single proposal was chosen as the best way to proceed. This plan calls for a one-time effort to clear the Providence River and Harbor of all floating debris, and barging the collected debris to a staging area at Field's Point in Providence. There it will be reduced in size, trucked to a landfill site in Johnston and buried.

The plan also calls for repair of partially dilapidated structures still in use and the erection of retaining fences along shorelines in front of shorefront dumps. This one-time cleanup could be accomplished in a two-year period, according to the Corps of Engineers. Changing conditions, such as the change in ownership status of the Johnston landfill site, could cause the Corps to alter this plan, or to select another plan as the best way to proceed.

Map 4 shows the Providence Harbor and River debris sources based on Army Corps survey maps. It is accompanied with a debris sources information key. The type of debris varies, from bulkheads to bridge fenders. The most common source of debris are dilapidated wharf structures. The total volume of debris in these sources noted is 300,330 cubic feet.

An Upper Narragansett Bay Debris Removal Program

The New England Division of the Army Corps of Engineers (COE) expects to complete the Providence Harbor debris study during Fiscal Year 1982, which begins in October, 1981. The report will then be sent to the Secretary of the Army for review prior to submittal to Congress for authorization and funding. The availability of federal funds will depend on local support in addition to the mood of Congress. The groundwork for building support should begin now, with a debris removal program based upon several initiatives:

1) state and local support and encouragement for the completion of the Corps of Engineers study.

2) support and assistance to a citizen-based shoreline debris clean-up in selected areas.

3) contacts with shorefront debris owners to encourage voluntary clean-up, in conjunction with a citizen effort in order to reduce debris inventory.

The Army Corps of Engineers has already been appraised of Rhode Island's interest in the completion of the debris study, through frequent contacts and cooperation with Coastal Resources Center staff. The OE and also participation in a meeting sponsored by

the Coastal Resources Management Council entitled "Providence Harbor: Problems and Prospects" on May 5, 1981, at which the debris removal problem was discussed at length.

An updated photographic inventory of debris sources in Providence Harbor undertaken by CRC during April 1981 was made available to the Corps of Engineers. Frequent reports will be made to the Coastal Resources Management Council and the public on the progress of the final phase of the COE Debris Study.

During June, 1981, four members of the 443 Civil Affairs Company of the Army Reserve began an analysis of the feasibility of a citizen volunteer effort to clean up loose shoreline debris in selected areas along the Upper Narragansett Bay shoreline. The unit was previously involved in Project ZAP, a massive one-day volunteer clean-up effort along the Blackstone in 1972. A volunteer clean-up effort would serve several purposes. First, a great deal of debris could be removed from specific areas such as beaches and coves, greatly improving their appearance. This would also reduce the inventory of Upper Narragansett Bay debris, and the money needed to remove it. Finally, the effort would heighten public awareness and interest in the debris removal problem.

The success of the debris removal project as proposed by the Army Corps of Engineers would be greatly enhanced in cooperation of the firms and landowners whose properties are debris sources. As Table 4-1 indicates, a 55 percent of total project costs are attributable to debris sources which have identifiable owners.

The Coastal Resources Management Program, adopted in 1977, established policy and regulations specifically prohibiting the abandonment of vessels, piers and wharves in the state navigable waters (section 520.1-2 (c) (page 180). A 1979 amendment to Section 46-6-8 of the General Laws of Rhode Island empowered the Department of Environmental Management to seek removal of such obstructions.

The utilization of these powers on a case by case basis for literally hundreds of debris owners would be costly and likely to foster resistance rather than cooperation. However, the State of Rhode Island can use its authorities to become directly involved in reducing the debris inventory through working with debris owners in the overall context of a debris removal program which includes the COE study and a volunteer clean-up effort.

The Rhode Island Coastal Resources Management Program's Upper Narragansett Bay task has provided funds during the past two years which have made possible a detailed analysis of the debris problem. Working with the Urban Waterfront Subcommittee of the Coastal Resources Management Council, CRC staff has explored options for getting some movement in debris removal. During the 1981-1982 fiscal year, CRC will be providing staff time in support of a volunteer clean-up project and efforts to encourage debris owners to remove or repair their facilities. This work will be part of its assignment to prepare a special area plan for Providence Harbor. The Army Reserve will complete its initial assessment of the best way to organize, encourage and support a volunteer debris clean-up effort which may be scheduled for the Spring of 1982.

Map 1

Debris Sources in Providence Harbor

◇ Structure in good condition

▲ Partially dilapidated

◆ Completely dilapidated

· Wrecked vessel

—— Loose shoreline debris

● Shorefront dump

Source: U.S. Army Corps of Engineers Providence River and Harbor and Seekonk River Debris Study. Feasibility Report. New England Division Corps of Engineers. 1978.


PROVIDENCE

DEBRIS SOURCES INFORMATION KEY

PROVIDENCE HARBOR

Structure Number	Total Volume to remove (cu. ft)	Total Removal Cost (1973) (dollars)	Type of Debris	Notes
102	2,100	7,235	wharf	-
*103	-	-	-	Mobil wharf
104	1,755	6,406	wharf	-
105	208	2,004	wharf	-
106	170	1,122	wharf	-
107	50	111	tree stump	-
*108	-	-	-	-
*109	-	-	-	-
110	227	1,683	bulkhead	-
111	13,868	44,543	wharf	Old Arco Dock
*112	-	-	-	Amoco Dock
*113	-	-	-	Gulf Oil Co.
114	420	1,506	dolphins	-
115	34,500	153,474	bulkhead	On or near Wilkesbarre Pi
116	860	3,194	wharf	Just south of Bold Point
117	22,000	80,795	wharf	-
118	1,358	4,825	wharf	-
119	240	1,778	marine railway	Just west of Bold Point
120	1,400	5,192	wharf	-
121	1,100	4,351	wharf	-
*122	-	-	-	-
*171	-	-	-	-
*172	-	-	-	-
*173	-	-	-	-
174	9,800	36,861	wharf	India Pt.
175	9,800	34,270	wharf	India Pt.
176	3,960	13,382	wharf	India Pt.
*177	-	-	-	-
178	8,700	29,625	wharf	India Pt. Park
179	14,200	46,662	wharf	India Pt. Park
180	430	2,518	wharf	-
181	3,900	12,748	wharf	-
*182	-	-	-	-
*183	-	-	-	-
184	8,200	37,615	wharf	-
185	170	870	wharf	-
186	4,800	20,282	wharf	-
187	700	3,728	bridge fenders	
*188	-	-	-	-
*189	-	-	-	-
190	270	1,072	wharf	-
191	90	357	bulkhead	-
192	50	199	bulkhead	-
193	20	79	bulkhead	-
*194	-	-	-	-

-continued-

DEBRIS SOURCES INFORMATION KEY
PROVIDENCE HARBOR

Structure Number	Total Volume to remove (cu. Ft.)	Total Removal Cost (1978) (dollars)	Type of Debris	Notes
*195	-	-	-	-
*196	-	-	-	-
197	15,705	60,805	wharf	Narr. Electric
*198	-	-	-	Narr. Electric
199	2,020	4,177	wharf	Narr. Electric
200	10,750	41,871	wharf	-
*201	-	-	-	-
202	44,600	173,045	wharf	C.H. Sprague
203	50	198	wharf	C.H. Sprague
*204	-	-	-	-
205	1,290	8,419	wharf	-
206	100	741	channel trough	
*207	-	-	-	-
208	4,700	18,302	wharf	50,673 Repair cos
209	2,930	42,538	wharf	42,538 Repair cos
210	3,510	19,119	wharf	42,159 Repair cos
211	40,650	156,460	wharf	
212	7,650	30,776	wharf	-
213	16,599	78,715	marine railway	
*214	-	-	-	Harbor Junct.
215	80	410	bulkhead	-
216	290	1,151	wharf	-
*217	-	-	-	-
*218	-	-	-	-
*219	-	-	-	-
*220	-	-	-	Municipal wharf
221	50	199	wharf	-
*222	-	-	-	-
*223	-	-	-	-
*227	-	-	-	Port Edgewood
228	829	3,352	wharf	-
*229	-	-	-	-
230	70	358	bulkhead	-
231	25	100	bulkhead	-
*232	-	-	-	-
234	1,242	6,091	wharf	-
235	770	3,339	wharf	-
239	840	3,443	wharf	-
*240	-	-	-	-
*241	-	-	-	-
*242	-	-	-	-
243	234	894	wharf	-

* These structures are in use and not in need of repair.

3.a. PROPOSED DEBRIS REMOVAL PROGRAM

To: Jim Beattie, Division of Coastal Resources
John Lyons, Coastal Resources Management Council
Dawn Giles, Department of Environmental Management
From: Donald Robadue, Coastal Resources Center
Re: Debris Removal Program Procedures
Date: 6 August 1981

Purpose of Debris Certification

Thes following proposed certification process would serve several purposes. First, it would provide accurate information on the nature and extent of the shoreline debris located on a particular parcel. The quantity would be estimated to determine eligibility for reduced or waived disposal fee, as well as measure progress on the removal effort. At the site inspection, recommendations on the best removal practice would be made, including cost saving measures. The follow up inspection would assure compliance prior to the disposal discount being offered.

Suggested Procedure

The basic steps in the certification program would be:

- o Notification of debris owners of the goals of the removal program (see attachment) requirements of present law, and potential benefits and incentives for compliance
- o Receipt of initial inquiries from owners
- o Division of Coastal Resources staff site inspection to identify location, type and amount of debris on site, recommend removal technique, and prepare Site Analysis Report (see attachment)
- o Action by debris owner, including disposal at State facility along with documentation provided in site analysis report
- o Reinspection of site to confirm compliance, issuance of Certificate of Compliance (see attachment) and notification of SWMC to provide fee discount/waiver.
- o Public recognition , if desired by certificate recipient.

The attachments are only intended to be rough drafts for refinement by the appropriate officials. In addition, clarification of the billing procedure used by the SWMC is necessary in order to assure a smooth flow of paper work without confusion over compliance.

P.S. Some of the detail in the letter could be placed in the informational brochure once those details are settled.

D R A F T

3.b Letter to Debris Owners

Date:

NAME:

Dear_____.

One of the legacies of the urbanization of Upper Narragansett Bay in this century is the accumulation of a large amount of shoreline debris. Dilapidated wharves and piers, abandoned and wrecked vessels, shorefront dumps and loose shoreline debris constitute a hazard to navigation, detracts from the visual quality of the Upper Bay and adversely affects the value and redevelopment potential of waterfront property.

The Rhode Island Coastal Resources Management Council and the Department of Environmental Management are cooperating in a three element program to remove debris from the Upper Narragansett Bay shoreline. This program includes:

- o Assisting the Army Corps of Engineers in its completion of a debris removal project plan begun in 1978. Approval by the Secretary of the Army is essential in order for Congressional appropriation of the federal share of costs.
- o Sponsoring a volunteer citizen shoreline clean-up in selected areas scheduled for May 1982.
- o Encouraging private owners of debris sources to repair or remove them.

In 1977 the Coastal Resources Management Council adopted a comprehensive coastal management program which includes a prohibition of the abandonment of vessels and marine structures (Section 520.1-2 c) In 1979 the General Assembly provided the Department of Environmental Management with the specific authority to enforce state policies pertaining to the abandonment of vessels and the accumulation of shore line debris.

According to the 1978 Army Corps of Engineers Study, recently updated by the URI Coastal Resources Center, only thirty firms or individuals own 88 percent of the total amount of debris attributable to shorefront structures in Upper Narragansett Bay. The property you own has been identified as the location of a structure which is classified as either a partly or completely dilapidated debris source. I am requesting your participation in a voluntary program to assist debris owners in removing their property from the inventory of debris sources. This will not only lead to immediate improvements in shoreline appearance and harbor safety, but will greatly reduce the burden of clean-up costs which otherwise must be borne by the tax paying public.

Several incentives are being offered to voluntary program participants:

- o A site inspection to determine the need for repair of removal, and recommended options which will include cost minimizing measures
- o A (waiver/reduction) of the disposal fee charged at the landfill operated by the Rhode Island Solid Waste Management Corporation has been arranged for certified program participants
- o Public recognition through the award of a certificate and press releases

To obtain more information on the debris removal probram and arrange for a site analysis, please contact:

John A. Lyons, Chairman
Coastal Resources Management Council
60 Davis Street
Providence Rhode Island 02908
(401)277-2476

Your cooperation is greatly appreciated by all Rhode Islanders who care about the future of Narragansett Bay.

Sincerely

3.c. Description of Individual Debris Reports

Dear

The following debris report consists of:

1) A listing of shorefront structures, located on property owned by you or your firm, which are sources of debris;

2) One or more maps showing the location of the structures;

3) Photographs of the structures where available.

The identification of structures as sources of debris, and the estimation of volume of material and cost of removal was done by the U.S. Army Corp of Engineers. This information was included in their draft feasibility report, Providence River and Harbor and Seekonk River Debris Study, written in 1978.

The Coastal Resources Center at the University of Rhode Island identified the owners of property on which the structures are located by examining maps and records in assessors' offices in the cities around Providence Harbor. The location of structures in relation to the property lines was verified by site visits, and inspection of ariel photographs and maps.

The Coastal Resources Center also made an attempt to update the cost estimates for the removal of the structures. This was done by using the Construction Cost Index published in Engineering News Record. The cost estimated cited in the following debris reports are based on the March 1981 index.

Since the Corp of Engineers' survey was done a number of years ago, the condition of the shorefront structures today may be different from what the debris study describes. The figures cited here should be taken as rough estimates of what it would cost today to remove the debris found by the Corp in 1978.

The Coastal Resources Management Council would like your cooperation in scheduling a site inspection by our staff engineers. In this way we could determine more accurately the location, size and nature of the debris sources. Discrepancies between your information about these structures and ours could be resolved, and your role (as owner of the debris source), in alleviating the problem would be clarified.

We are looking forward to working with you in solving the debris problem in Providence Harbor.

Sincerely,

3.d. Draft Site Analysis Report Outline

State of Rhode Island and Providence Plantations

Department of Environmental Management
Division of Coastal Resources

Coastal Resources Management
Council

60 Davis Street
Providence RI

File Number

Date

SITE ANALYSIS REPORT

UPPER NARRAGANSETT BAY DEBRIS REMOVAL PROGRAM

Name and address of debris owner:

Debris source location:

street and number

pole number

city/town

plat number

lot number

Army Corps of Engineers survey number

TYPE OF DEBRIS

DESCRIPTION (locate on lot)

ESTIMATED VOLUME AND WEIGHT

RECOMMENDED REMOVAL, REPAIR OR RESTORATION TECHNIQUE

Photographs, comments

inspector name:

3.e. Draft Certificate of Compliance

State of Rhode Island and Providence Plantations

Department of Environmental Management
Division of Coastal Resources

Coastal Resources Management Council

60 Davis Street
Providence, RI

File number

Date

Army Corps Of Engineers Survey Number

CERTIFICATE OF COMPLIANCE

UPPER NARRAGANSETT BAY DEBRIS REMOVAL PROGRAM

This document certifies that: (name,address of owner) has complied with Section 520.1-2(c) of the Rhode Island Coastal Resources Management Program and Section 46-6-8 of the General Laws of Rhode Island by removing _____ located at (street and number, municipality,) on (plat, and lot numbers) as determ ined by a site inspection on (date) conducted by (name of inspector).

The certificate recipient is eligible for a (reduction/waiver) of the fee customarily charged for disposal of materials at the (proper name of Johnston landfill) as well as public recognition for cooperation with the Upper Narragansett Bay Debris Removal Program.

Signatures

4. A Volunteer Effort to Remove Loose Onshore Debris in Upper Narragansett Bay

A VOLUNTEER EFFORT

TO REMOVE

LOOSE ON-SHORE DEBRIS

IN THE

UPPER NARAGANSETT BAY

A FEASIBILITY STUDY

by

LLBrd CIVIL AFFAIRS COMPANY
U.S. ARMY RESERVE
WARWICK, R.I.

Introduction

The Coastal Resources Center wrote to the Commanding General of the 94th U.S. Army Reserve Command in January 1981 requesting the support of that command for a debris removal effort in Upper Narragansett Bay. This request was forwarded to the 443rd Civil Affairs Company in March 1981. Soon afterwards, direct communication was established between Robert McKillop of the Coastal Resources Center and the 443rd Civil Affairs Company.

As a result of this communication, the 443rd Civil Affairs Company accepted the mission of conducting a study to determine the feasibility of a volunteer effort to remove loose on-shore debris in the Upper Narragansett Bay.

Scope of this study

It was decided during the preliminary stages of this project that the 443rd Civil Affairs Company would limit its study to a volunteer clean-up effort of loose on-shore debris. This decision was based on two key factors:

A. The Army Corps of Engineers had completed in 1978 an extensive and comprehensive report on debris removal in the Upper Bay and contiguous waterways. This report, together with additional studies and actions by the Coastal Resources Council and related organizations, had identified a three phase debris removal effort:

   1. a major one time effort by the Corps of Engineers (funded jointly by federal cost sharing and non-federal funds) to remove delapidated wharves and piers, sunken barges etc.
   2. an effort by the R.I. Department of Environmental Management to identify owners of delapidated shore-front buildings, wharves and piers etc. and to use existing laws to order removal of the debris.
   3. a volunteer clean-up effort to remove debris and thereby reduce the costs of item A1 (above).

B. A volunteer effort (identified in A3 above) would require extensive planning, coordination and preparation and would be by its very nature limited in scope to what relatively unskilled and unequipped volunteers could do manually with a few hours effort.

Project ZAP

Project ZAP was a major volunteer effort to clean up the Blackstone River in September 1972. Project ZAP was eminently successful and has been used both locally and nationally as a model for volunteer clean-up campaigns.

Unit members of the 443rd Civil Affairs Company did extensive research on Project ZAP as a major part of this feasibility study. Both newspaper clippings maintained in the Journal-Bulletin "morgue" and a scrapbook maintained by Leighton Authier (Director of Project ZAP and a Journal-Bulletin manager) were used as resources. Unit members also interviewed two of the key leaders of Project ZAP: Leighton Authier and Clarence Gaudette (Director of the Blackstone River Watershed Association). Both men were very cooperative and extremely helpful and we are most appreciative of their assistance.

Key features of Project ZAP were:

- Strong, centralized leadership with decentralized local functional control. Essentially, Project ZAP coordinators did all the major planning, recruited all key personnel, obtained all heavy equipment and other donations, established lines of communications (both in advance and on the clean-up day itself) and allocated resources to each of eight local sections; the responsibilities for identification of debris, assignment of volunteers, and initiating requests for specific types of heavy equipment and other materials were decentralized to the level of "section chairman". The Blackstone River was divided into eight clearly identified sections; a chairman was responsible for the "hands-on" clean-up of a specific section. Volunteers were asked to report to the Headquarters of a specific section and at that time signed liability releases, received instructions and safety rules, and were assigned to particular projects under the leadership of team captains and coordinators.

- Extensive publicity. The Providence Journal-Bulletin was the sponsor of Project ZAP. Leighton Authier, a Journal-Bulletin employee, served as the Director of Project ZAP. The Journal-Bulletin also provided a telephone number which was used by anyone wishing to donate equipment, materials, their own volunteer labor etc. Newspaper publicity was extensive and was probably a key element to the success of Project ZAP.

Articles were used to:

- Solicit and recognize public support and specific committments.
- Solicit and recognize the support of business and industry, and to request donations of specific equipment.
- Inform volunteers of what to bring, what to wear, where to report, safety precautions, etc.
- Publicize endorsemrnts of political, civic, and industrial leaders.
- Generate an atmosphere of community support and cooperation which climaxed in the feeling that participating in ZAP was the "thing to do".

- Intensive planning over a long period of time.
- Widespread support of political, civic, and business leaders.
- A full-time staff to serve as the nucleus of leadership. These were several individuals who worked full time (either as volunteers or as paid representatives of another organization, eg. the R.I. National Guard) planning and coordinating Project ZAP. A full-time staff is especially important during the final stages of a volunteer project; the initial stages could be under the direction of one person.
- A one-day effort. This provides maximum exposure and a concentration of resources plus a fuller coordination of efforts.

Benefits of a volunteer debris removal project

- Immediately removes some debris at a minimum cost.
- Educates the general public; heightens public sensitivity to the problem of pollution.
- Offers the individual a chance to "do something" to improve the environment.
- Provides leverage to use when dealing with identified owners of debris.
- Provides additional support to use when seeking legislation to fund removal of debris.
- Serves as a specific accomplishment that an agency (eg. Coastal Resources Center, D.E.M., Save the Bay) can use as an example of progress and accomplishment.
- Spawns other clean-up campaigns (eg. Bar-ZAP, Clean-up of the Pawtuxet, etc).

Suggested Functional Organization

- General Chairman
- Legal Advisor (legal implications of any activities; releases by volunteers and donors of equipment; access to shoreline; etc.)
- Communications Chairman (military and civilian radio equipment for the day of the activity)
- Publicity Chairman (newspaper releases; slogan; bumper stickers; identification pins; radio station support/sponsorship; public service announcements)
- Equipment chairman (heavy equipment; gloves; trash bags; etc.)
- R.I. National Guard Coordinator
- Volunteer Chairman (recruit and assign volunteers; traffic control; direction signs; train team leaders; non-National Guard military support)
- Disposal Chairman (sites; permits; agency coordination)
- Health and Safety Chairman (medical support; safety instructions)
- Food Services Chairman (coffee breaks; lunch; cold drinks)
- State/Community Liaison Chairman (coordinate with state agencies and local municipalities)

Limiting Factors

- Disposal site
- Public response
- Weather
- Professional Staff
- Sponsor

Work Schedule

By Oct. 15 • Select sponsor (eg. Save the Bay, D.E.M.)

Oct. 30 • Recruit General Chairman

Nov. 15 • Obtain Journal-Bulletin cooperation/sponsorship

Nov. 30 • Initial publicity

Nov. 30 • Meet with all organizations with vested interests. Obtain their endorsements, full cooperation and staff support.

Dec. 15 • Develop organization

Dec. 15 • Develop initial plan of action and timetable

Jan. 15 • Recruit functional chairmen (see Suggested Functional Organization)

Feb. 1 • Obtain radio station cooperation

Feb. 1 • Additional publicity

Feb. 1 • Fully develop a final plan of action and timetable

Mar. 1 • Recruit for specific needs (manpower and materials)

Mar. 1 • Full-time staffing

Mar. 15 • Begin intensive publicity

Apr. 1 • Coordinate actions, needs, resources

Conclusion and Recommendations

A volunteer effort to remove loose on-shore debris in the upper Narragansett Bay is feasible. A successful effort will require much work, detailed planning, excellent leadership, and cooperation by many agencies and organizations. There is always the risk that an undertaking that is this extensive and ambitious may not be a complete success: however, one shore front resident summed up his feelings when he asked, "When are you going to stop studying this mess and do something about it?".

We recommend that a one day effort be scheduled for the spring of 1982 (on Saturday, May 8, 15 or 22). Spring is the traditional clean-up season, generally offers mild weather and still avoids the vacation season. The day selected should ideally have low tide between the hours of 12:00 noon and 2:00 PM (or as close to this as possible on the suggested dates) so as to offer maximum access to the shore. A target date of May, 1982 affords sufficient time to plan and organize this effort and to mobilize widespread community support.

10 March 1982
DEBRIS REMOVAL WORK GROUP
Options for Debris Clean-up & Disposal in the Seekonk River

1

Outline of
Proposed State Debris Removal Program

a. Letter to debris owners describing cooperative clean-up incentives program

b. Site inspections to determine actual debris problem, and terms of compliance

c. cost estimate of removal

d. Area Debris Task Force and coordinated control program

e. Timetable for compliance

f. Certification of removal compliance

DEBRIS REMOVAL PROGRAM GROUP

Debris Removal Program

1. Basic Approach
   a. Implement CRMC policy, DEM authority
   b. Encourage Army Corps project
   c. Volunteer cleanup of selected areas
2. Working Group Response
   a. Support, but work independently of Corps
   b. Emphasize incentives rather than legal action
   c. Divide harbor into sub-areas
   d. Begin detailed planning & implementation in Seekonk River

Incentives Program

1. Reduced disposal fees at state landfill ($4.50 ton)
2. Coordinated planning to obtain economies of scale by, CRMC, DEM, local
   a. establish subareas & clean-up groups
   b. certification/documentation by DEM
   c. sub-area inventories & specific removal plans to reduce costs for debris owners
3. Investigate sources of low-interest financing, i.e. EDC/RIPA

Seekonk River Debris Owners

Name	#	Est. Cost
Almacs	149	$ 17,815
American	Vessels	186,111
Brennan	166	24,383
City of Providence	169	-
Eddy Chevrolet	157	17,301
Marvern Co.	154	10,508
Merchants Dist.	158	8,913
Pawtucket Ready-M	153	1,636
Pawtucket Red. Ag.	160	11,413
Penn Central	168	1,615
Promet	139.140,142	54,738
Valley Gas	161,162	4,134
Washburn Wire	148	3,884
		$ 342,451

19% of total project costs for structures

Options for Area-wide Debris Removal,
Seekonk River

a. Individual compliance

In this option, no special effort would be made to coordinate the clean-up of privately owned structures in order to achieve potential cost reductions. A small crew could be organized and made available to individuals with small amounts of debris. Each owner would be free to comply as he sees fit. A volunteer effort and other activities to focus public attention on the problem would be the focus of the Task Force.

b. Site by site removal

In this option, trucking to the disposal site would be coordinated to achieve a possible transportation cost savings. Each owner would stockpile the debris on his own site, waiting for a crew with a large hauling vehicle and payloader to remove the material. Several small sites could be handled in a few trips. Owners would pay their portion of the total cost.

Advantages:
- potential cost savings on hauling is an incentive for participation
- no extra collection site needed
- likely to result in substantial reduction of debris inventory due to coordinated effort

Disadvantages:
- cost must be fairly allocated
- coordination essential, requiring careful management
- all must cooperate if savings to be realized

c. Centralized collection site

In this option, one or two central locations would be established to collect debris from various owners. Hauling to the disposal site would be achieved in a continuous operation once the site was full, with no need to bring trucks and payloaders to each site.

Advantages:
- cooperation of all debris owners in a short period of time less crucial
- greater symbolic value, i.e. progress more evident
- more compatible with a volunteer clean-up program

Charge of the Seekonk Debris Removal Task Force

a. Group should be composed of debris owners, citizens, public officials, contractors

b. State will initiate program

c. Public endorsement, encouragement required as follow-up to State effort

d. Detailed plans for area clean-up prepared by Task Force/ State, including best removal practices and efficient disposal

e. Pressure on communities/owners for compliance

f. Convene public meetings, organize publicity

g. Organize volunteer clean-up

h. Serve as a model effort for other clean-up areas

Disadvantages: requires double handling of debris
cost allocation harder to determine
collection site must be located
less resistant to failure of project, i.e. nonpayment of hauling costs by owners, or lack of management and oversight
collection sites may attract unwanted garbage and trash

d. Questions for discussion

(1) Which is cheapest?

(2) How can a fair allocation of hauling costs be made?

(3) Which is most resistant to failure?

(4) Which sites would be most effectively handled separately?